THE *NEPHROTOMA* SPECIES OF JAPAN (DIPTERA, TIPULIDAE)

by

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Abstract

Thirty-five Japanese species and subspecies of *Nephrotoma* are discussed. Five taxa, *leeuweni*, *vana vana*, *vana nigrovana*, *pallida*, and *medioflava*, are new. Type-material was examined of all species and their synonyms, except two. Eight new synonyms are proposed. A key to the species is presented. The distribution of the species and subspecies is summarized. The total number of species on the main Japanese islands is: Hokkaido 21, Honshu 28, Shikoku and Kyushu 14. Eleven species are endemic to Japan, another four to Japan and the Kurile Islands.

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Introduction

The Japanese species of *Nephrotoma* Meigen, 1803, are revised as part of a revision of the Holarctic members of the genus (Oosterbroek, 1978—1980, 1984; Tangelder, 1983, 1984). With 35 species and subspecies, *Nephrotoma* is the largest tipulid genus in Japan (table 1).

Five taxa are described here for the first time, in addition to the three new species described by Tangelder (1984). The sequence in which the species are discussed and their distribution is given in table 3. A number of species are treated in detail elsewhere (Oosterbroek, 1978—1980: western Palaearctic species; Tangelder, 1984:

Table 1. Palaearctic (sub)genera of Tipulidae known from Japan (number of Japanese species in brackets, after Theowald & Oosterbroek, 1985).

Dolichopeza (*Dolichopeza*)	(2)
Dolichopeza (*Nesopeza*)	(5)
Dolichopeza (*Oropeza*)	(5)
Macgregoromyia	(4)
Leptotarsus (*Longurio*)	(2)
Holorusia	(2)
Nephrotoma	(35)
Tipula (*Acutipula*)	(7)
Tipula (*Arctotipula*)	(1)
Tipula (*Dendrotipula*)	(3)
Tipula (*Emodotipula*)	(1)
Tipula (*Indotipula*)	(4)
Tipula (*Lunatipula*)	(8)
Tipula (*Nippotipula*)	(1)
Tipula (*Platytipula*)	(16)
Tipula (*Pterelachisus*)	(19)
Tipula (*Savtshenkia*)	(3)
Tipula (*Schummelia*)	(2)
Tipula (*Sinotipula*)	(1)
Tipula (*Tipula*)	(1)
Tipula (*Tipulodina*)	(2)
Tipula (*Trichotipula*)	(1)
Tipula (*Vestiplex*)	(6)
Tipula (*Yamatotipula*)	(15)
Tipula, subg. uncertain	(20)
Ctenophora (*Cnemoncosis*)	(4)
Ctenophora (*Ctenophora*)	(4)
Dictenidia	(3)
Phoroctenia	(1)
Pselliophora	(3)
Tanyptera (*Protanyptera*)	(4)
Tanyptera (*Tanyptera*)	(2)
Tanyptera, subg. uncertain	(1)
	(188)

Table 2. Palaearctic (sub)genera of Tipulidae not known from Japan (number of Palaearctic species in brackets, after Theowald & Oosterbroek, 1985).

Dolichopeza (*Sineropeza*)	(1)
Prionocera	(15)
Nigrotipula	(2)
Tipula (*Angarotipula*)	(4)
Tipula (*Beringotipula*)	(2)
Tipula (*Brithura*)	(6)
Tipula (*Formotipula*)	(9)
Tipula (*Lindnerina*)	(6)
Tipula (*Mediotipula*)	(12)
Tipula (*Odonatisca*)	(7)
Tipula (*Triplicitipula*)	(4)
Ctenophora (*Xiphuromorpha*)	(1)

species of the *dorsalis* group) and are only briefly dealt with here.

The total number of Tipulidae known to occur in Japan is 188. They belong to 31 of the in total 43 Palaearctic (sub)genera (tables 1 and 2). It is estimated that the total number of Japanese Tipulidae lies around 230. A historic review on the study of the Japanese tipulids is given by Alexander (1953b). Catalogues are published by Masaki (1933a) and Ishida (1955—1961, 1965). About half the Japanese species of *Nephrotoma* are treated in detail, based on material examined, in Savchenko's revision of the Palaearctic Tipulidae (part 5, 1973, in Russian, under the now suppressed name *Pales* Meigen, 1800).

THE GENUS NEPHROTOMA

Nephrotoma is a large genus, with at present over 400 recognized species and subspecies. It has a world-wide distribution but is especially rich in species in the Holarctic, Oriental and Afrotropical Regions (Oosterbroek & Schuckard, 1976).

The species of *Nephrotoma* can be found in many different landscapes of the world (pine-, deciduous-, mixed-, rain- and monsoon-forests, meadows, steppes, savannas and even tundras as far north as 82°30′), but in general they prefer the temperate climates, which allow the development of deciduous forests and where edges of woods, meadows and banks of streams form the most favourable habitats.

The larvae are usually found in soils rich in humus. In some species they gnaw at the roots of cultivated plants, now and then causing damage to oats, rye, sugarbeets, flax, cabbage and coniferous seedlings. For northern Japan damage to sugarbeets by larvae of *minuticornis* (locally known as the Ao-hoso-gaganbo, sugarbeet crane-fly) is reported by Kuwayama (1926) and Shiraki (1952), though considered by Alexander (1953d) of minor economic importance.

Very few information is available about the biology of the species. Masaki (1933b) discusses, under the name *virgata*, the biology and all life stages of a species of the *dorsalis* group. For a few species more detailed information is available from the continent (Oosterbroek, Schuckard & Theowald, 1976; Oosterbroek, 1978—1980; Savchenko, 1973).

CHARACTERS
(figs. 1—5)

Nephrotoma specimens are usually yellow with dark yellow to black markings on head, thorax and abdomen. Very characteristic are the three broad longitudinal stripes on scutum one and the two such stripes on scutum two. A few species are almost entirely yellow, in others the yellow ground-colour is almost or completely superseded by dark brown or black.

Apart from coloration, *Nephrotoma* is characterized by the wing venation (fig. 2): vein Rs is very short and vein CUA1, or, if present, cross-vein m-cu, meets vein M before or at the anterior corner of the discal cell.

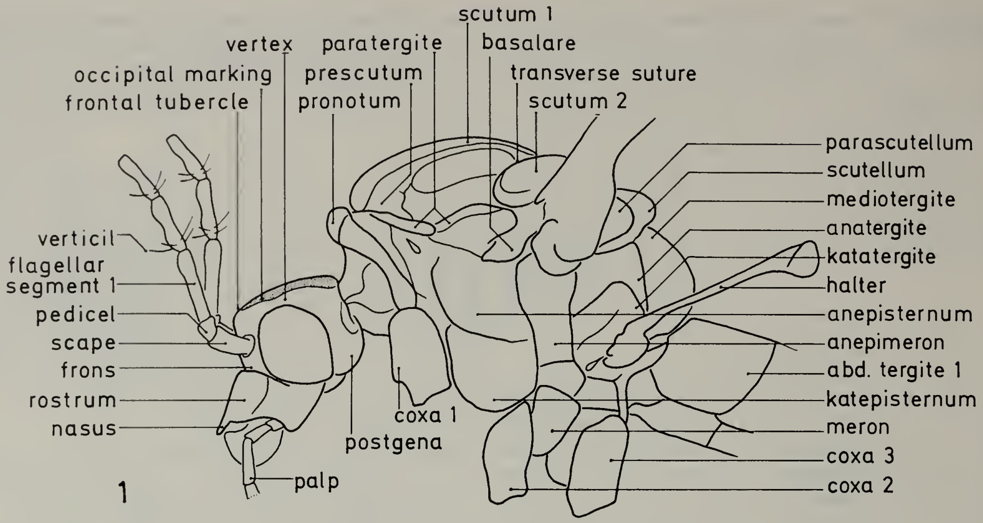
Especially the male copulatory organs (fig. 3) provide important characters for the identification of species and for phylogenetic analysis. Most of the characters necessary to identify species are visible from the outside. The female ovipositor (figs. 4, 5) also possesses many characters and in some instances they are the only reliable clue to separate females of closely related species. However, in dry specimens most of the ovipository characters can not be examined.

During copulation the female hypovalvae enter the dorsal part of the hypopygium. They are kept in position by the embrace of the inner and outer dististyles and the ventrally excavated extension of the ninth tergite. The cerci of the female remain outside the hypopygium, but closely adjusted to the ninth and/or eighth sternites of the male. Depending on the species groups, these sternites show a great variety of shapes, hair- or bristle-tufts, and appendages to guide the cerci. The same applies to the extension of the male tergite nine and the inner and outer dististyles with respect to the hypovalvae. Apart from guiding, practically all the external copulatory organs are equiped with sensory spines, bristles, bristle-like hairs, etc.

The fused valvulae and the furca are two sclerotized plates situated between the cerci and the

Table 3. List of species of *Nephrotoma* with their synonyms and distribution. (+) = types examined by Tangelder, 1984.

Species groups	Species	Type-mat. examined	New synonymy	Hokkaido	Honshu	Shikoku	Kyushu	Tsushima	S Japanese islands	Sado	West Palaearctic	Amur obl. + Khabar. kr.	Sakhalin + Moneron	Kurile islands	Northeast China + Korea	South Primorye	East China	Southwest China
cornicina	*aculeata*	+			+						+	+	+		+	+		
	(*a. atricauda*)	+																
	cornicina	+		+	+	+	+	+			+	+	+	+	+	+	+	
	esakii	+		+	+	+	+			+				+				
	saghaliensis	+		+	+							+	+	+	+			
	subpallida	+			+	+	+			+								
parvirostra	*daisensis*	+			+	+		+							+	+		
	flammeola	+		+	+	+	+			+				+	+	+		
	parvirostra	+		+	+		+	+				+	+	+	+	+		+
	(*serristyla*)	+	+															
	(*immemorata*)	+	+															
fuscescens	*contrasta*	+		+	+													
	flavonota	+			+	+	+	+									+	
	fuscescens				+	+	+	+								+		
	(*iyoensis*)	+	+															
	(*akitae*)	+	+															
	leeuweni	+			+													
analis	*ozenumensis*	+			+									+				
	vana vana	+		+										+				
	vana nigrovana	+			+		+											
	pullata	+		+	+	+	+			+		+			+	+		
	(*hokkaidensis*)	+																
	(*mannheimsi*)	+	+															
	stygia	+		+	+									+				
palloris	*bifusca*	+			+	+						+			+	+		
	geminata	+			+													
	pallida	+					+		+									
	palloris	+		+	+								+	+				
	(*autumnalis*)	+	+															
crocata	*neopratensis*	+		+	+	+									+			
brevipennis	*hirsuticauda*	+		+	+							+	+	+	+	+		
stylacantha	*medioflava*	+							+									
repanda	*repanda*	+		+	+	+	+	+		+				+	+	+		+
	(*grahamiana*)	+	+															
virgata	*virgata*	+		+	+	+	+	+	+	+		+			+	+		+
	(*decrepita*)	+	+															
	(*japonica*)																	
dorsalis	*electripennis*	(+)				+	+											
	nigricauda	(+)		+	+									+				
	minuticornis	(+)		+	+	+	+						+	+				
	sachalina	(+)		+								+	+	+				
	difficilis	(+)		+								+	+		+	+		
	angustistria	(+)		+	+													
	cirrata	(+)		+														
	gaganboi	(+)			+													
	microcera	(+)		+	+										+			
				21	28	14	14	7	3	6								



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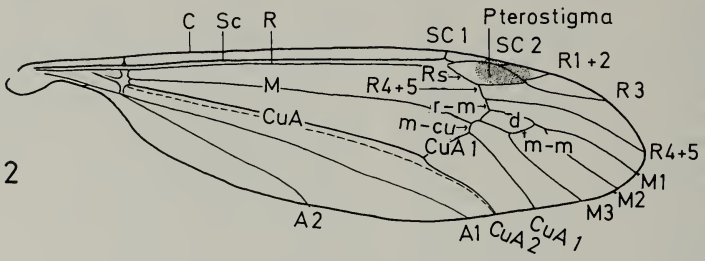

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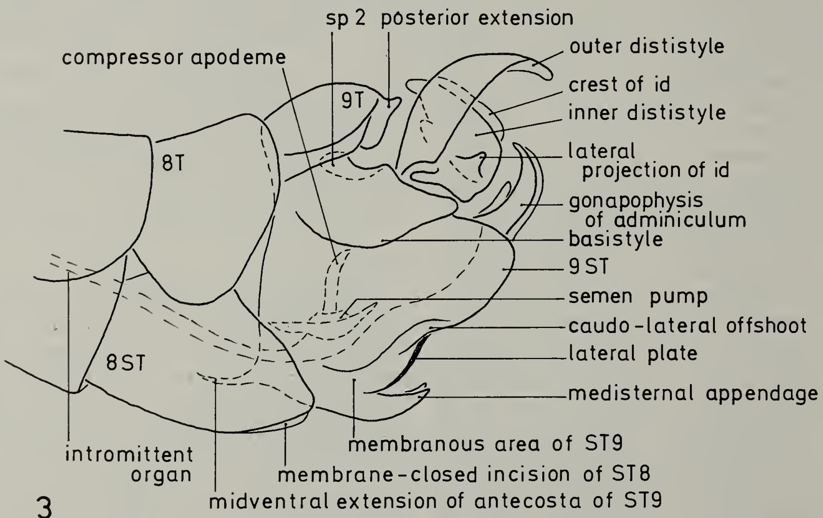

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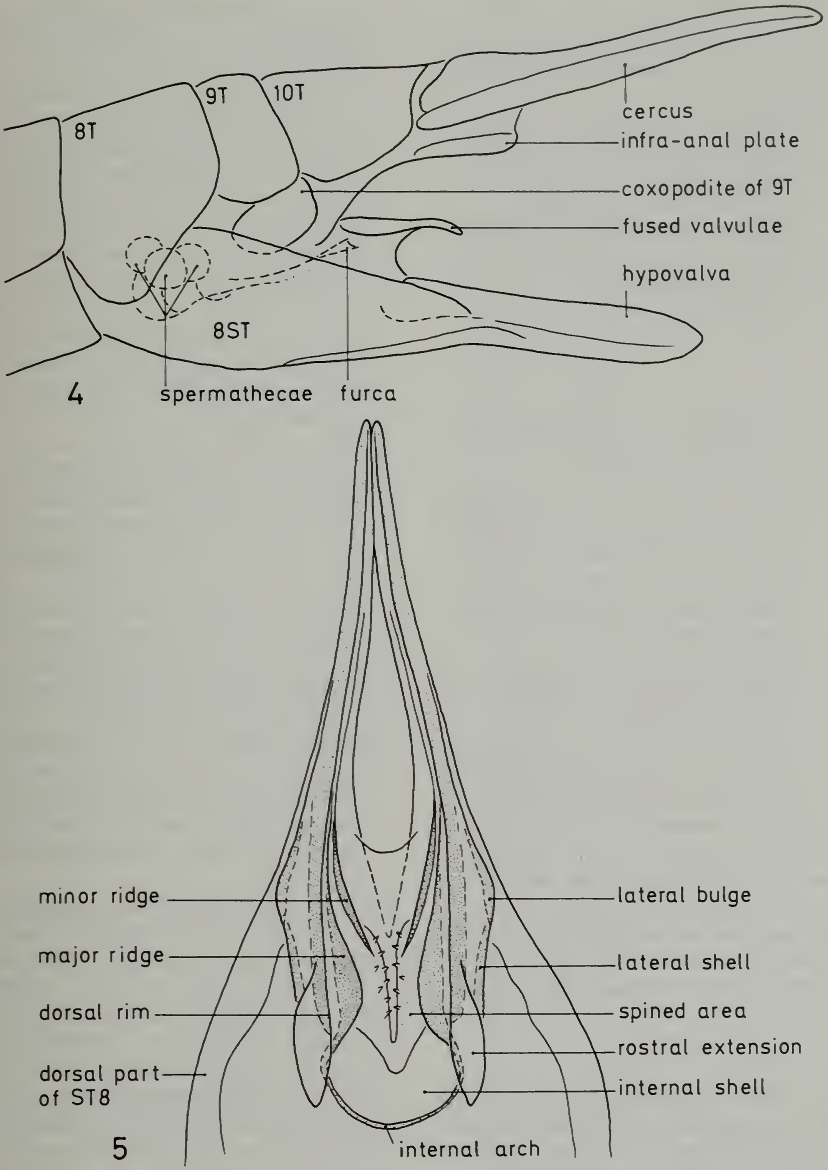
Fig. 1. Generalized drawing of head and thorax. Fig. 2. Wing of *N. eucera*; A, anal vein; C, costa; Cu, cubitus; d, discal cell; M, medius; R, radius; Sc, subcosta. Fig. 3. Generalized drawing of hypopygium; id, inner diststyle; ST, sternite; T, tergite. (Reproduced with kind permission from Tangelder, 1983, Beaufortia 33: 113)



Figs. 4—5. Generalized drawing of ovipositor (fig. 4, lateral view) and hypovalvae (fig. 5, dorsal view); ST, sternite; T, tergite. (Reproduced with kind permission from Tangelder, 1983, Beaufortia 33: 113)

hypovalvae. The opening of the bursa copulatrix is situated underneath the fused valvulae. The position of the male intromittent organ is secured during copulation by the adminiculum itself, and by its lateral appendages, the gonapophyses. The intromittent organ is usually a thin tube, running from the semen pump in the direction of the thorax and with a downward loop back to the adminiculum. Its length varies from about 2 mm to about 40 mm (in *N. helvetica* with the intromittent organ spirally coiled inside the abdomen) and the part towards the adminiculum can show various modifications (bipartite, tripartite, with a serrate membrane or a robust spine), usually characteristic for the species group.

MATERIAL

This study is based on material preserved in the following institutions and, except for ZMA, received on loan:

ASL	Academy of Sciences, Zoological Institute, Leningrad, USSR
BM(NH)	British Museum (Natural History), London, Great Britain
IPSFK	Institut für Pflanzenschutzforschung Kleinmachnow, Eberswalde, East Germany
KU	Kyushu University, Kyushu, Japan
KURU	Kurume University, Kyushu, Japan
MAK	Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, West Germany
RMNH	Rijksmuseum van Natuurlijke Historie, Leiden, the Netherlands
UKaL	University of Kansas, Lawrence, USA
USNM	United States National Museum, Washington DC, USA
USNMA	United States National Museum, Washington DC, USA, C. P. Alexander collection
ZMA	Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam, the Netherlands

Practically all the material is preserved dry. Drawings of the genital structures were made after maceration in KOH and with the aid of a drawing tube on a Wild microscope.

Different localities are separated in the text by a semicolon (;), whereas additional information about a locality is separated from it by a comma.

KEY TO THE SPECIES

1. Lateral stripes on scutum 1 very broad, reaching paratergite, and shining. Almost entire thorax shining. Scutellum, mediotergite and lateral thorax chocolate brown to dark brown with the membranous area below paratergite and anterior half of katatergite yellowish. Abdominal segments 5—8(9) blackened. Male with a peculiar shaped appendage at sternite 8 (figs. 12, 16). Female with the cerci and hypovalvae very short (fig. 13) .... *esakii*

— Not with the above combination of characters 2

2. Male with a slender, posteriorly directed appendage at sternite 8 (figs. 9—11). Posterior margin of outer dististyle in part sclerotized (figs. 10, 11). Female cerci pointed (figs. 5, 6, 7) 3

— Male without or with a differently shaped appendage. Outer dististyle not sclerotized. Female cerci ending blunt or cerci and hypovalvae very short (figs. 17, 51, 53) 5

3. Outcurved anterior end of lateral stripe on scutum 1 or mark below anterior end dull. Medial appendage of male sternite 8 knobshaped (fig. 11) .... *cornicina*

— Outcurved anterior end of lateral stripe on scutum 1 or mark below anterior end shining. Medial appendage of male sternite 8 very acute (fig. 10) or apically rounded and concave (fig. 9) 4

4. Wing usually with numerous macrotrichia in apical cells. Medial appendage of male sternite 8 apically rounded and concave (fig. 9). Outer dististyle abbreviated (fig. 8). Female hypovalvae abbreviated (fig. 6) .... *saghaliensis*

— Wing without or with few macrotrichia in apical cells. Medial appendage of male sternite 8 very acute (fig. 10). Outer dististyle elongate (fig. 10). Female hypovalvae slender, not abbreviated (fig. 7) ...... *aculeata*

5. Mediotergite yellowish on anterior part, at least in the middle (anterior part sometimes transparent in *minuticornis*, characterized by the straight lateral stripes on scutum 1 and the yellow antero-lateral corners of scutum 2) 6

— Antero-medial part of mediotergite with a brown to black longitudinal stripe or mediotergite (almost) entirely darkened ... 26

6. Thorax entirely yellowish, including the dorsal stripes. Lateral stripes on scutum 1 straight. Medisternal appendage elongate and strongly hirsute (figs. 38, 41) *flavonota*

— Thorax with at least the scutal stripes in part light brown to black. Lateral stripes on scutum 1 straight, straight with an isolated spot below anterior end, or stripes anteriorly outcurved. Medisternal appendage otherwise 7

7. Medial stripe on scutum 1 divided into two by a narrow longitudinal line which is, especially on the anterior part, dull. Medial and lateral stripes on scutum 1 narrowly dull bordered where opposing each other. Anterior end of lateral stripes outcurved and dull. Lateral pronotum darkened on dorsal part only. Inner dististyle with a high, rectangular, dorsal crest (fig. 26).

Male sternite 8 with a cranially directed appendage (figs. 25, 28) .... *flammeola*

— Not with the above combination of characters 8

8. Lateral parts of mediotergite distinctly darker coloured than antero-medial part. Male sternite 8 unmodified 9

— Lateral parts of mediotergite concolorous with anteromedial part, sometimes anteromedial part more transparent. Hind margin of male sternite 8 modified except in *subpallida* 17

9. Anterior part of lateral stripes on scutum 1 outcurved and shining. Stripes on scutum 1 and 2 brownish, sometimes vague, rarely partly dark brown. Dorsal surface of abdominal tergite 1 brown with a, usually large and transverse, yellow mark in the middle. Inner dististyle with a low dorsal crest (fig. 108) .... *medioflava*

— Lateral stripes on scutum 1 straight, with a, usually isolated, dull spot below anterior end. Scutal stripes usually at least partly dark brown or black. Tergite 1 without yellow mark mid-dorsally. Inner dististyle with a posterior crest (fig. 87) or without crest (figs. 76, 80) 10

10. Males (see also characteristics under *palloris*, p. 263) 11

— Females (see also characteristics under *palloris*, p. 264) 14

11. Inner dististyle without crest (figs. 76, 80) 12

— Inner dististyle with a posterior crest (fig. 87) 13

12. Posterior part of inner dististyle blackened (fig. 80) .... *bifusca*

— Posterior part of inner dististyle not blackened (fig. 76) .... *geminata*

13. Outer dististyle broad (fig. 77) ..... *palloris*

— Outer dististyle slender (fig. 84) .... *pallida*

14. Dorsal margin of sternite 8 distinctly upcurved before reaching hypovalva (figs. 88, 91) .... *bifusca*

— Dorsal margin of sternite 8 more or less straight (figs. 89, 90) 15

15. Cerci slender (fig. 89) .... *geminata*

— Cerci broad (fig. 90) 16

16. Rostral extensions of hypovalvae broad (fig. 93) .... *palloris*

— Rostral extensions of hypovalvae narrower (fig. 92) .... *pallida*

17. Lateral thorax and coxae with large dark brown to black markings. Cerci and hypovalvae shortened (figs. 51—54) 18

— Lateral thorax and coxae yellowish, markings at most light brown. Cerci and hypovalvae not shortened 20

18. Posterior part of inner dististyle with a large, blackened outgrowth (fig. 58). Female unknown .... *leeuweni*

— Posterior part of inner dististyle without a blackened outgrowth (figs. 45, 49) 19

19. Dorsal margin of inner dististyle posteriorly upcurved (fig. 45). Extension of male tergite 9 with the lateral margins of the medial incision concave (fig. 44). Hypovalvae with a small dorsal notch before apex (fig. 51) .... *fuscescens*

— Inner dististyle dorsally more or less straight (fig. 49). Medial incision with convex lateral margins (fig. 48). Hypovalvae without dorsal notch before apex (fig. 53) .... *contrasta*

20. Lateral stripes on scutum 1 straight or anteriorly outcurved and shining 21

— Lateral stripes on scutum 1 anteriorly outcurved, the outcurved part dull 23

21. Antero-lateral corners of scutum 2 yellow in front of stripes. Medial stripe on scutum 1 usually (narrowly) of lighter colour along mid-line. Large species, male 13.5—16 mm, female 17—21.5 mm .... *minuticornis*

— Antero-lateral corners of scutum 2 with a dull, dark brown to black seam bordering anterior end of stripes. Medial stripe on scutum 1 usually uniformly coloured. Smaller species, male 10—15 mm, females 12—18 mm 22

22. Male sternite 8 with a triangular and laterally compressed medial appendage (fig. 32). Crest of inner dististyle serrate (fig. 35). Stripes on scutum 2 uniformly coloured. Female cerci slender, hypovalvae broad (fig. 31) .... *parvirostra*

— Male sternite 8 deeply incised, the incision lined with tufts of long yellow hairs (fig. 100). Crest of inner dististyle rounded (fig. 103). Stripes on scutum 2 of lighter colour in the middle. Female cerci moderately broad, hypovalvae moderately slender (fig. 101) .... *hirsuticauda*

23. Medial stripe on scutum 1 posteriorly dull and prolonged to occupy the central part of the transverse suture .... *repanda*

— Medial stripe on scutum 1 posteriorly shining and not occupying transverse suture 24

24. Prescutum dull between thoracic stripes. Abdominal end not blackened. Male sternite 8 unmodified .... *subpallida*

— Prescutum shining between thoracic stripes. Abdominal end blackened. Male sternite 8 modified (figs. 121—124) 25

25. Scutum 2 dull between stripes. Male sternite 8 deeply incised, lateral margins of the incision convex and set with small black spines (figs. 123, 124)........ *electripennis*

— Scutum 2 shining between stripes. Male sternite 8 with distinctly prolonged lateral corners, apically set with small black spines (figs. 121, 122) .... *nigricauda*

26. Pterostigma inconspicuous, at most light brown 27

— Pterostigma distinct, brown to dark brown 28

27. Antennae with 11 segments in both sexes. Prescutum shining between thoracic stripes. Abdomen with more or less continuous dark brown stripes dorsally, laterally and ventrally.................. *microcera*

— Antennae 13-segmented in both sexes. Prescutum dull between thoracic stripes. Abdomen usually with triangular dorsal markings, practically unmarked laterally and ventrally .... *virgata*

28. Lateral thorax without dark brown markings. Prescutum shining between thoracic stripes. Katatergite shining 29

— Lateral thorax with large brown to black markings. Prescutum dull between thoracic stripes. Katatergite dull 33

29. Lateral stripes on scutum 1 anteriorly outcurved and shining. Occipital marking large, basally as broad as dorsal part of pronotum and with convex lateral margins .... *gaganboi*

— Lateral stripes on scutum 1 straight. Occipital marking shortly triangular, or narrow and elongate 30

30. Antennae with 18—19 segments in the male, 15—16 in the female. Caudal corners of male sternite 8 strongly extended (fig. 120) .... *sachalina*

— Antennae with 13 segments in both sexes. Caudal corners of male sternite 8 otherwise 31

31. Antero-lateral corners of scutum 2 brownish. Occipital marking shortly triangular, brown .... *cirrata*

— Antero-lateral corners of scutum 2 dark brown to black. Occipital marking narrow and elongate, dark brown (figs. 126, 127) 32

32. Occipital marking more or less elongate triangular (fig. 126). Medisternal appendage of male sternite 9 directed ventrally (figs. 130, 131). Female cerci rather short and broad (fig. 128)................. *difficilis*

— Occipital marking a narrow stripe or spot (fig. 127). Medisternal appendage of male sternite 9 directed caudally (fig. 132). Female cerci long and slender (fig. 129) .... *angustistria*

33. Lateral stripes on scutum 1 with a large and shining, outcurved anterior end. Occipital marking in front narrowly in contact with spots along eye-margin (fig. 21). Inner dististyle with a serrate crest (fig. 23). Male sternite 8 with an elongate, cranially directed appendage (fig. 22) .... *daisensis*

— Lateral stripes of scutum 1 straight, or anteriorly outcurved and dull. Occipital marking otherwise. Inner dististyle and male sternite 8 otherwise 34

34. Lateral stripes on scutum 1 anteriorly outcurved and dull. Extension of male tergite 9 consisting of two shells (figs. 61, 67) 35

— Lateral stripes on scutum 1 straight or weakly outcurved. Extension of male tergite 9 protruding (figs. 72, 99) 37

35. Thorax almost entirely darkened with the scutal stripes broadly in contact with each other or area between stripes more or less concolorous with the stripes (not dusted grey as in *neopratensis*). Tergites 2—4 with broadly triangular, transverse markings along hind margins, segments 5—8 blackened .... *vana nigrovana*

— Thorax yellow between stripes and laterally yellow with large dark brown to black markings. Tergites 2—5 (6) usually with elongate markings which are more triangular towards hind margin, segments 6—7 (8) blackened 36

36. Outer dististyle sinuate with the apical part very slender and elongate (fig. 65) (see also under characteristics of *vana*, p. 256) .... *ozenumensis*

— Outer dististyle less sinuate (fig. 63) (see also under characteristics of *vana*, p. 256) .... *vana vana*

37. Occipital marking laterally broadly in contact with the eyes. Dorsal thorax yellow between stripes. Male sternite 8 without appendage....................... *pullata*

— Occipital marking not contacting the eyes. Dorsal thorax heavily dusted grey between and laterad of stripes. Male sternite 8 with a triangular appendage (figs. 96, 98) .... *neopratensis*

The *cornicina* group

Nephrotoma aculeata (Loew, 1871) (figs. 7, 10)

Pachyrhina aculeata Loew, 1871: 20—22.
Nephrotoma aculeata; Oosterbroek, 1978: 61—68 (species revision).
Nephrotoma aculeata atricauda Alexander, 1924: 599.

Material examined. — From Japan: 1♂, Honshu, Nagano, 3.vii.1943 (USNMA).

Characteristics. — *N. aculeata* belongs to the *cornicina* subgroup (Oosterbroek, 1980), the species of which possess a mid-posterior appendage on the semen pump (Oosterbroek, 1980, fig. 18), have the outer dististyle partly sclerotized (figs. 10, 11), and the male sternite 8 with an elongate appendage, very slender and acute in *aculeata* (fig. 10), and the female cerci pointed (figs. 6, 7). *N. aculeata* is closely related to *N. tenuipes* (not Japanese), *saghaliensis* and *cornicina*. In *cornicina* the outcurved anterior part of the lateral scutum one stripe is dull, in the other three species it is shining and in *aculeata* usually isolated from the stripe. Moreover, *tenuipes* and usually also *saghaliensis* possess numerous macrotrichia in the apical wingcells. *N. saghaliensis* is furthermore characterized by the small occipital marking, the peculiar shaped appendage of the male sternite 8 (fig. 9), the short outer dististyle (fig. 8), and the abbreviated hypovalvae (fig. 6), whereas the other three species possess more elongate hypovalvae (fig. 7).

Distribution and period of flight. — *N. aculeata* is distributed throughout the Palaearctic from the British Isles to Sakhalin and Kamchatka. Adults are on the wing from early June to early September. During this study only 1♂ from Japan, Honshu, was examined (see below).

Discussion. — The type-material of *aculeata atricauda* Alexander, 1924 (1♂ holotype, 1♂ 1♀ paratype, all from Sakhalin, Toyohara = Yuzhno-Sakhalinsk) was examined by the present author in 1982 (USNMA). This has confirmed the opinion of Savchenko (1973: 132) that *atricauda* should not be considered a separate subspecies because all the characters mentioned by Alexander fall within the variability of *aculeata*. The species is reported by Ishida (1965) from Hokkaido, Honshu and Shikoku under the name *aculeata atricauda*. In spite of the fact that during this study many *Nephrotoma* material from these islands was examined, only one *aculeata* male from Honshu was found. For the moment, therefore, it remains questionable whether the species occurs on Hokkaido and Shikoku as well.

Nephrotoma cornicina (Linnaeus, 1758) (fig. 11)

Tipula cornicina Linnaeus, 1758: 586.
Nephrotoma cornicina; Oosterbroek, 1978: 100—109 (species revision).

Material examined. — From Japan: 13♂ 18♀, Hokkaido; 23♂ 23♀, Honshu; 3♀, Shikoku; 7♂ 13♀, Kyushu and 1♂, Tsushima.

Characteristics. — See under *aculeata*, male hypopygium as in fig. 11.

Distribution and period of flight. — Widespread throughout the Palaearctic from the British Isles and Spain to Sakhalin and the islands bordering Kamchatka, in China as far South as Shanghai. Known from the Japanese islands Hokkaido, Honshu, Shikoku (Tokushima; Ehime), Kyushu and Tsushima. The period of flight in Japan is from mid-May until the end of August.

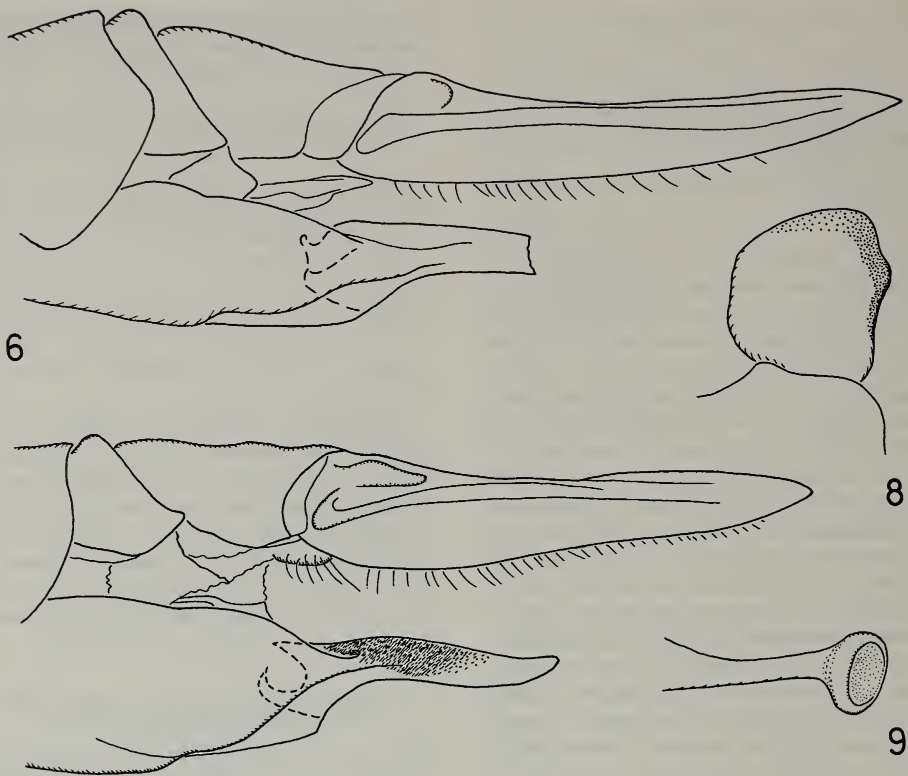
Nephrotoma esakii Alexander, 1924 (figs. 12—16)

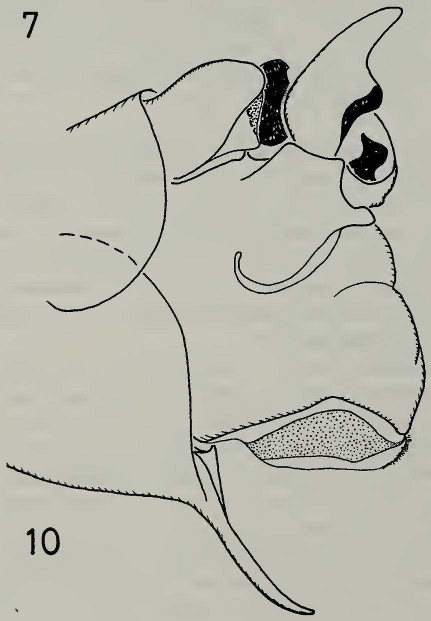
Nephrotoma esakii Alexander, 1924: 596, 597. Alexander, 1925c: 4. Masaki, 1933a: 91. Alexander, 1935b: 226. Alexander, 1953c: 147, 148. Ishida, 1955: 121. Savchenko, 1970: 121.
Pales esakii; Savchenko & Krivolutzkaya, 1966: 46, 56. Savchenko, 1973: 121, 122.

Material examined. — Holotype ♀, in good condition, labelled "Kamio toineppu, Hokkaido viii-25-1922 Teiso Esaki" "Holotype *Nephrotoma esakii* Alex." (USNMA); other material: 1♀, Kurile (Kunashir); 3♂ 2♀, Sado; 1♂ 1♀, Hokkaido (Sapporo); 23♂ 15♀, Honshu; 2♂ 2♀, Kyushu (Kumamota; Oita); 1♂ 1♀, Shikoku (without locality).

Characteristics. — Belongs to the *cornicina* subgroup (semen pump with a midposterior appendage, outer dististyle partly sclerotized, hind margin of male sternite 8 with a midventral appendage). *N. esakii* can easily be recognized by coloration (see key), the males by the peculiar shaped midventral appendage of sternite 8 (figs. 12, 16), and the females by the very short ovipositor (fig. 13). The extension of the male tergite 9 possesses a few spines only (fig. 15) and the crest of the inner dististyle is narrow (fig. 14).

Distribution and period of flight. — Known from the islands Kunashir, Sado, Hokkaido,





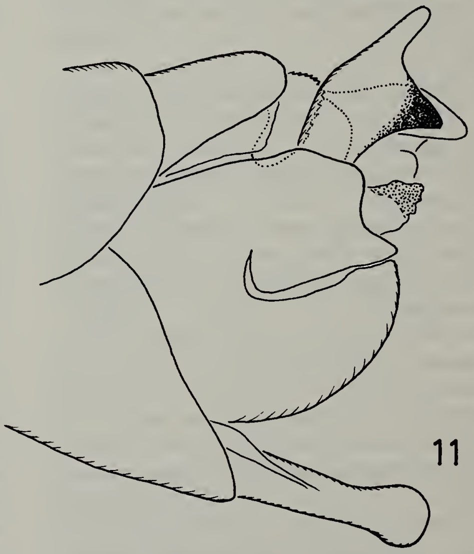
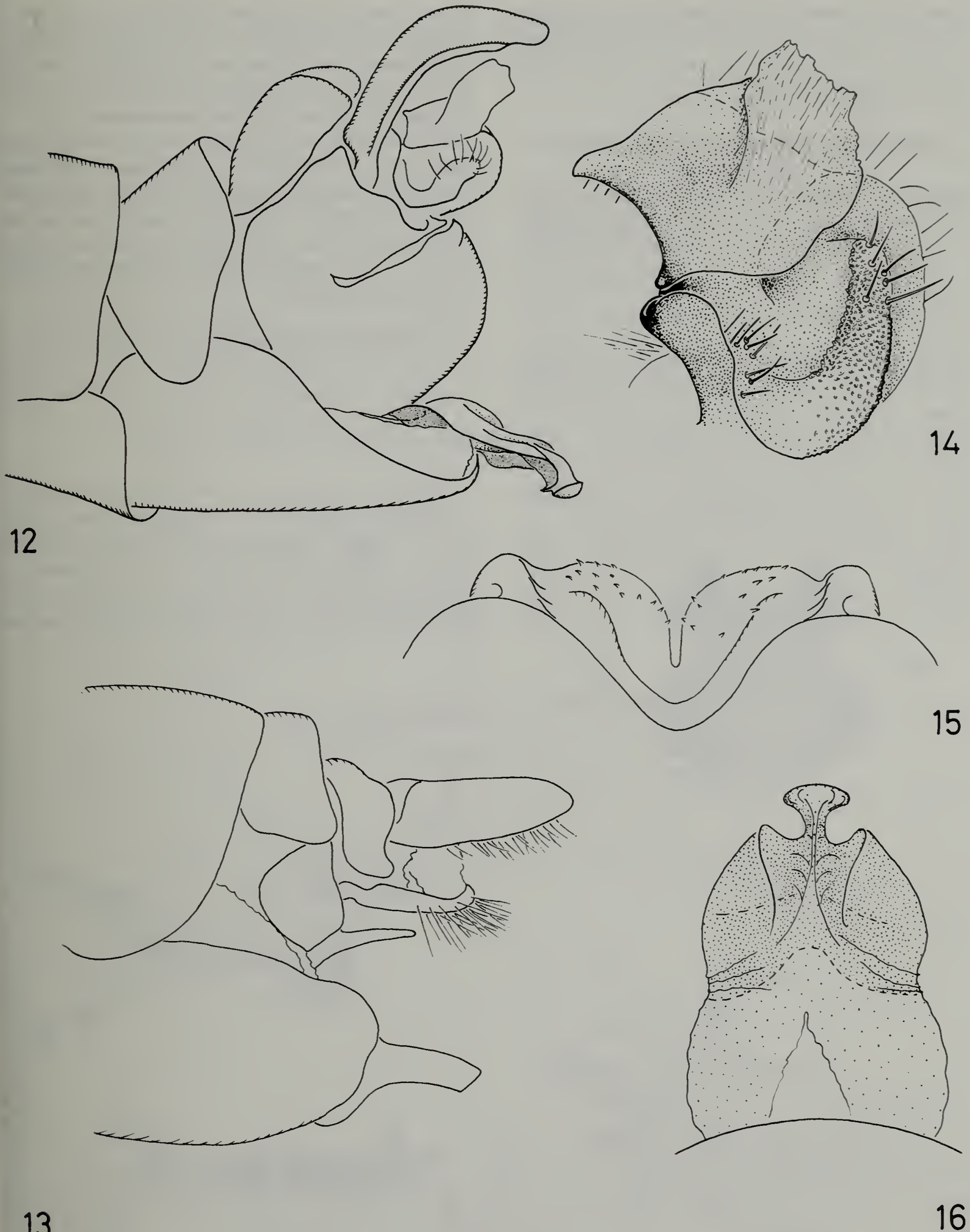


Fig. 6. Ovipositor of *N. saghaliensis*, lateral view. Fig. 7. Ovipositor of *N. aculeata*, lateral view. Fig. 8. Left outer dististyle of *N. saghaliensis*, from outside. Fig. 9. Medial appendage of male sternite 8 of *N. saghaliensis*. Fig. 10. Hypopygium of *N. aculeata*, lateral view. Fig. 11. Hypopygium of *N. cornicina*, lateral view.



Figs. 12—16. *N. esakii*. Fig. 12. Hypopygium, lateral view. Fig. 13. Ovipositor, lateral view. Fig. 14. Left inner dististyle, from outside. Fig. 15. Extension of male tergite 9, dorsal view. Fig. 16. Medial appendage of male sternite 8, ventral view.

Honshu, Kyushu and Shikoku. The species is frequently reported from altitudes up to 1300 m. The period of flight is from the beginning of July to mid-September.

Nephrotoma saghaliensis Alexander, 1925
(fig. 6, 8, 9)

Nephrotoma saghaliensis Alexander, 1925a: 447, 448. Alexander, 1927: 10. Alexander, 1931: 339. Masaki, 1933a: 91. Ishida, 1955: 123. Savchenko, 1970: 121.

Pales saghaliensis; Savchenko & Krivolutzkaya; 1966: 47, 56. Savchenko, 1973: 133, 134.

Material examined. — Holotype ♂, in good condition, one wing on slide 2473, specimen labelled "Toyohara Karafuto Japan viii-29-1921 S. Kuwayana" "Holotype *Nephrotoma saghaliensis* C. P. Alexander" (USNMA; the type-locality Toyohara = Yuhzno-Sakhalinsk); paratype ♂, wing on slide 2473, from Honshu, Yumoto, 5820′, 23.vii.1923 (USNMA); other material: 3♂ 1♀, Kamchatka (Dalny); 1♂ 1♀, Sakhalin (Nakano); 1♂, Kunashir; 1♂, Shikotan; 1♂, Yuri (Isl. SW Shikotan); 2♂ 1♀, Hokkaido (Iwama; Onpetsu; Sapporo); 12♂ 13♀, Honshu; 2♂ 2♀, North Korea (Puksu Pyaksan in Kankyo Nando, the second highest peak in Korea, appr. 40° 40′ N 127° 45′ E).

Characteristics. — See under *aculeata*.

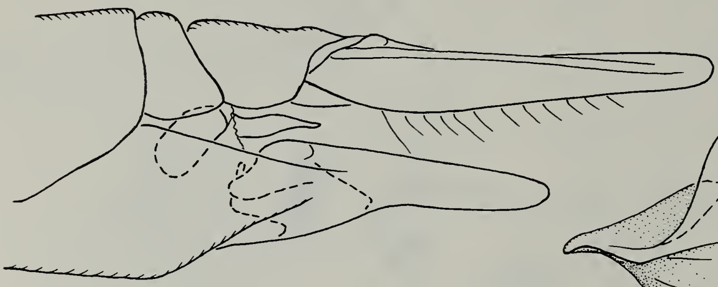
Distribution and period of flight. — *N. saghaliensis* is known from Kamchatka, Sakhalin, Moneron, Iturup, Kunashir, Shikotan, Shibotsu, Yuri, Hokkaido, Honshu, Amurskaya oblast and North Korea. Recorded altitudes are up to 2000 m. The period of flight is from early July until mid-September.

Nephrotoma subpallida Alexander, 1925
(figs. 17—20)

Nephrotoma subpallida Alexander, 1925b: 401, 402. Masaki, 1933a: 92. Ishida, 1955: 124.

Pales subpallida; Savchenko, 1973: 163.

Material examined. — Holotype ♂, in good condition, labelled "Mt Minomo Japan vi-22, 1922 T. Esaki" "Holotype *Nephrotoma subpallida* C. P. Alexander" (USNMA; Mt Minomo is on Honshu); paratypes: 1♂ 1♀, labelled as the holotype (♂ with wing and parts of abdomen on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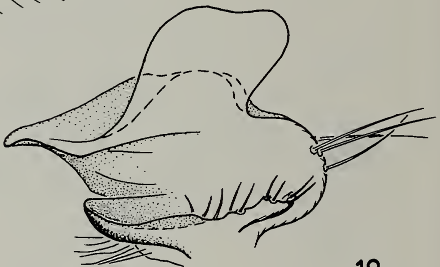
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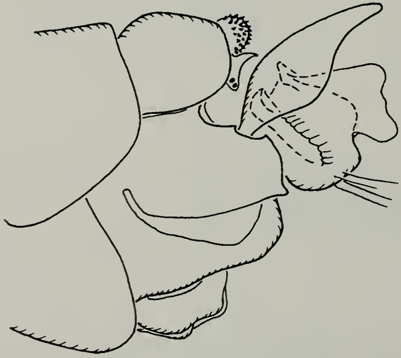
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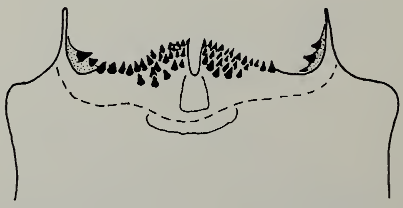
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Figs. 17—20. *N. subpallida*. Fig. 17. Ovipositor, lateral view. Fig. 18. Left inner dististyle, from outside. Fig. 19. Hypopygium, lateral view. Fig. 20. Extension of male tergite 9, dorsal view.

slide 2535, USNMA); other material: 11♂ 3♀, Honshu; 2♂, Sado; 1♀, Shikoku (Betssiyama, Ehime); 2♂ 2♀, Kyushu (Shiratoriyama, Kumamoto; Chojabaru, Oita).

Characteristics. — *N. subpallida* can easily be recognized by the characters mentioned in the key. The female cerci are relatively broad and short (fig. 17). The male intromittent organ has the apical two-thirds trifid, a character known from the *flavescens* subgroup of the *cornicina* group only (Oosterbroek, 1980).

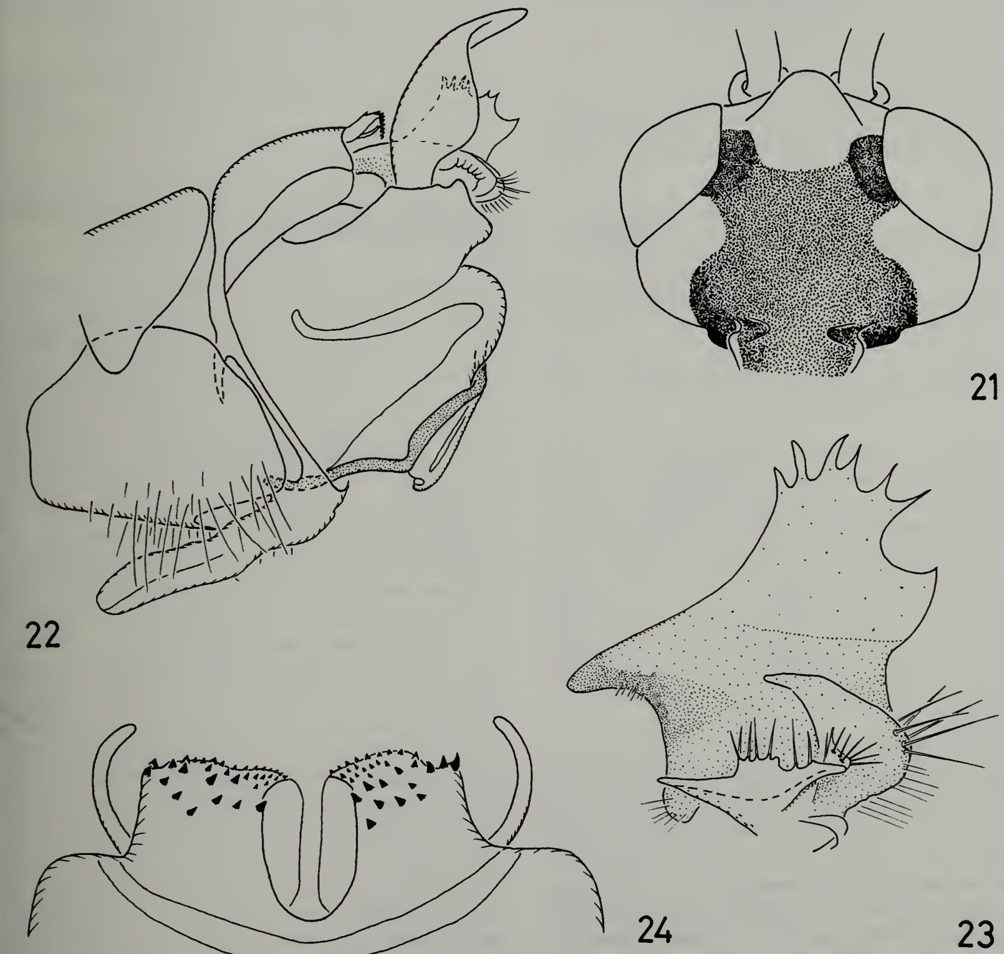
Distribution and period of flight. — The species was known from Honshu only, but material was examined now from Sado, Shikoku and Kyushu as well. Adults were collected between May 28 and August 3, with one record from September 25.

The *parvirostra* group

Nephrotoma daisensis Alexander, 1935
(figs. 21—24)

Nephrotoma daisensis Alexander, 1935b: 236—238. Alexander, 1953c: 145, 146. Ishida, 1955: 120, 121. Savchenko, 1981: 77.
Pales daisensis; Savchenko, 1973: 161, 162.

Material examined. — Holotype ♀, in good condition, labelled "Mt Daisen Tottori, Japan 800 met. vi-6, '30 Nibi" "Holotype *Nephroto-*



Figs. 21—24. *N. daisensis*. Fig. 21. Head, dorsal view. Fig. 22. Hypopygium, lateral view. Fig. 23. Left inner dististyle, from outside. Fig. 24. Extension of male tergite 9, dorsal view.

ma daisensis C. P. Alexander" (USNMA; Mt Daisen is on Honshu); other material: 1♂ 2♀, Honshu (Rokushosan, Fukui; Kurokawa, Echigo); 1♂, Tsushima (Mt Ariake); 1♀, South Korea (Central Nat. Forest, 18 mi NE Seoul).

Characteristics. — The structures of the extension of the male tergite 9 (fig. 24) and the inner dististyle (fig. 23) clearly show that the species is closely related to *parvirostra*. The coloration, however, is very different from the yellowish *parvirostra*. The occipital marking is large and of a characteristic shape (fig. 21), the thorax is variegated with large dark brown to black markings, the abdominal tergites 2—5 possess large triangular markings on the posterior two-thirds and the segments 6—8 (9) are blackened. The wings are brownish with especially in the females the apex broadly clouded.

Distribution and period of flight. — Known from Honshu, Shikoku (Alexander, 1953c: Mt Tsurugi), Tsushima, South Korea and southern Primorye (Savchenko, 1981: Kedrova Pad). The recorded period of flight is from May 9 to July 7.

Nephrotoma flammeola Alexander, 1925
(figs. 25—28)

Nephrotoma flammeola Alexander, 1925b: 400, 401. Masaki, 1933a: 92. Ishida, 1955: 121. Savchenko, 1970: 121.

Pales flammeola; Savchenko & Krivolutzkaya, 1966: 46, 56. Savchenko, 1973: 160, 161.

Material examined. — Holotype ♂, in fair condition, one wing and abdominal end on slide 2468, specimen labelled "Gifu, Japan v-25 1921 Takeuchi" "Holotype *Nephrotoma flammeola* C. P. Alexander" (USNMA; Gifu is on Honshu); other material: 1♂ 3♀, Hokkaido (Soounkyo; Sapporo; Jozankei); 11♂ 12♀, Honshu; 1♂, Kyushu (Shiratoriyama, Kumamoto); 3♂ 5♀, Shikoku; 1♂, Sado; 7♂ 3♀, South Korea (Central Nat. Forest, 18 mi NE Seoul).

Characteristics. — As given in the key. Occipital marking small, triangular, dark brown to almost absent. Between tubercle and eyes dark brown spots. Transverse suture darkened, especially in the middle. Lateral thorax mainly yellow, anatergite and posterior half of katatergite usually darkened. Hypopygial structures as in figs. 25—28. The species apparently belongs to the *parvirostra* group.

Distribution and period of flight. — The species is known from South Korea, the Japanese islands Hokkaido, Honshu, Kyushu, Shikoku and Sado, and is reported by Savchenko from Kunashir and southern Primorye. The species is most abundant in July and August with a few records from June and the first half of September. At altitudes up to 1500 m.

Nephrotoma parvirostra Alexander, 1924
(figs. 29—35)

Nephrotoma parvirostra Alexander, 1924: 600, 601. Masaki, 1933a: 92. Ishida, 1955: 123. Alexander, 1966: 120. Savchenko, 1970: 121.

Pales parvirostra; Zinovjev & Savchenko, 1962: 556, 557, 562—569. Savchenko & Krivolutzkaya, 1966: 46, 56.

Pales parvirostra parvirostra; Savchenko, 1973: 116, 117.

Nephrotoma immemorata Alexander, 1935a: 139, 140. (**Syn. nov.**)

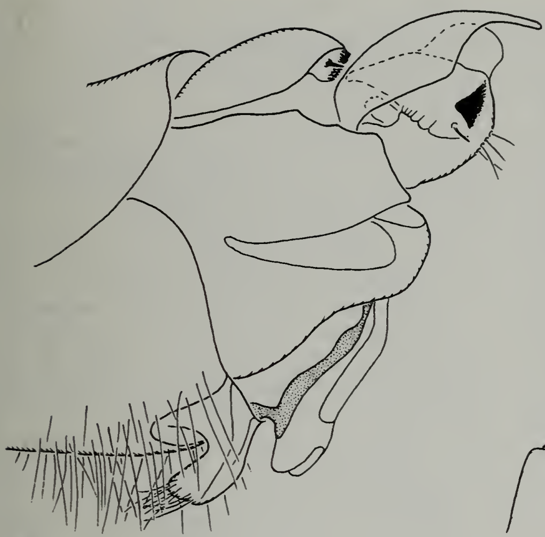
Pales immemorata; Savchenko, 1973: 119.

Nephrotoma serristyla Alexander, 1935b: 226—228. (**Syn. nov.**)

Pales parvirostra serristyla; Savchenko, 1973: 118, 119.

The references by Mannheims & Savchenko (1967) and Savchenko, Violovich & Narchuk (1972) refer to *relicta*, see under discussion.

Material examined. — Holotype ♂ of *parvirostra*, in good condition, labelled: "Sapporo, Japan M. Hori" "Holotype *Nephrotoma parvirostra* C. P. Alexander" (USNMA); paratypes: 1♂ (wing and hypopygium on slide 2472), Hokkaido, Sapporo, 25.vii.1921 (USNMA); 1♂, Hokkaido, Shikaripetsu, 26.viii.1922 (USNMA); 1♂, Hokkaido, Kamiokoppe, 27.viii.1922 (USNMA) (see for localities Alexander, 1924). Holotype ♂ of *immemorata*, in fair condition, one wing, one antenna and hypopygium on slide 5737, specimen labelled: "Mt Omei Szechwan China Aug. 23, '29" "Holotype *Nephrotoma immemorata* C. P. Alexander" (USNMA) (Alexander, 1935b, fig. 47, does not indicate the serrate dorsal crest of the inner dististyle, but the crest is present in the holotype). Holotype ♂ of *serristyla*, in good condition, labelled: "Chungking 1—2000 ft v.6-27.30" "Szechwan China D C Graham" "Holotype *Nephrotoma serristyla* C. P. Alexander" (USNMA); paratypes (all USNMA): 3♂ 2♀ para(topo)types and 1♂ paratype from Chabarovsk, Amur, Primorye, 26.vii.1927, Stackelberg (apparently the paratype from Ussuri Railway, Alexander, 1924); other material: 2♂, Kunashir; 1♂, Shikotan; 14♂ 10♀, Hokkaido; 10♂ 7♀, Honshu; 2♂, Kyushu (Shiiba, Kuma-



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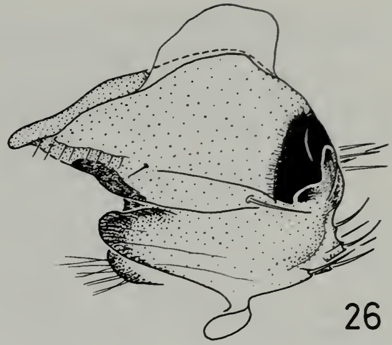

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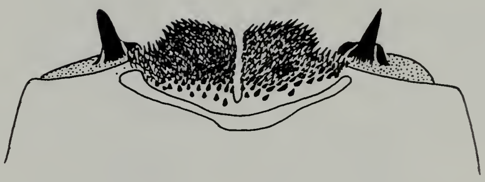

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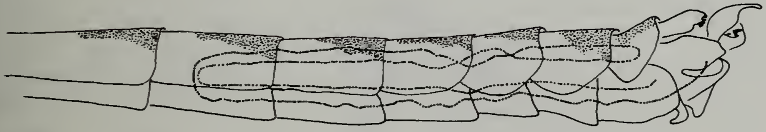

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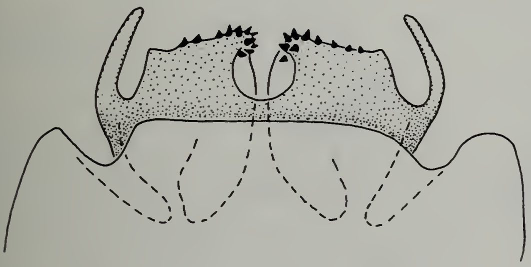

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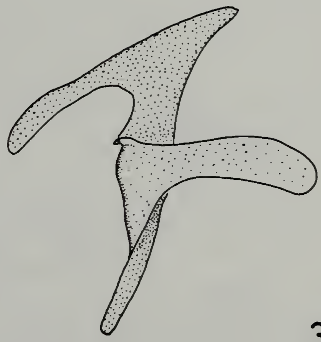

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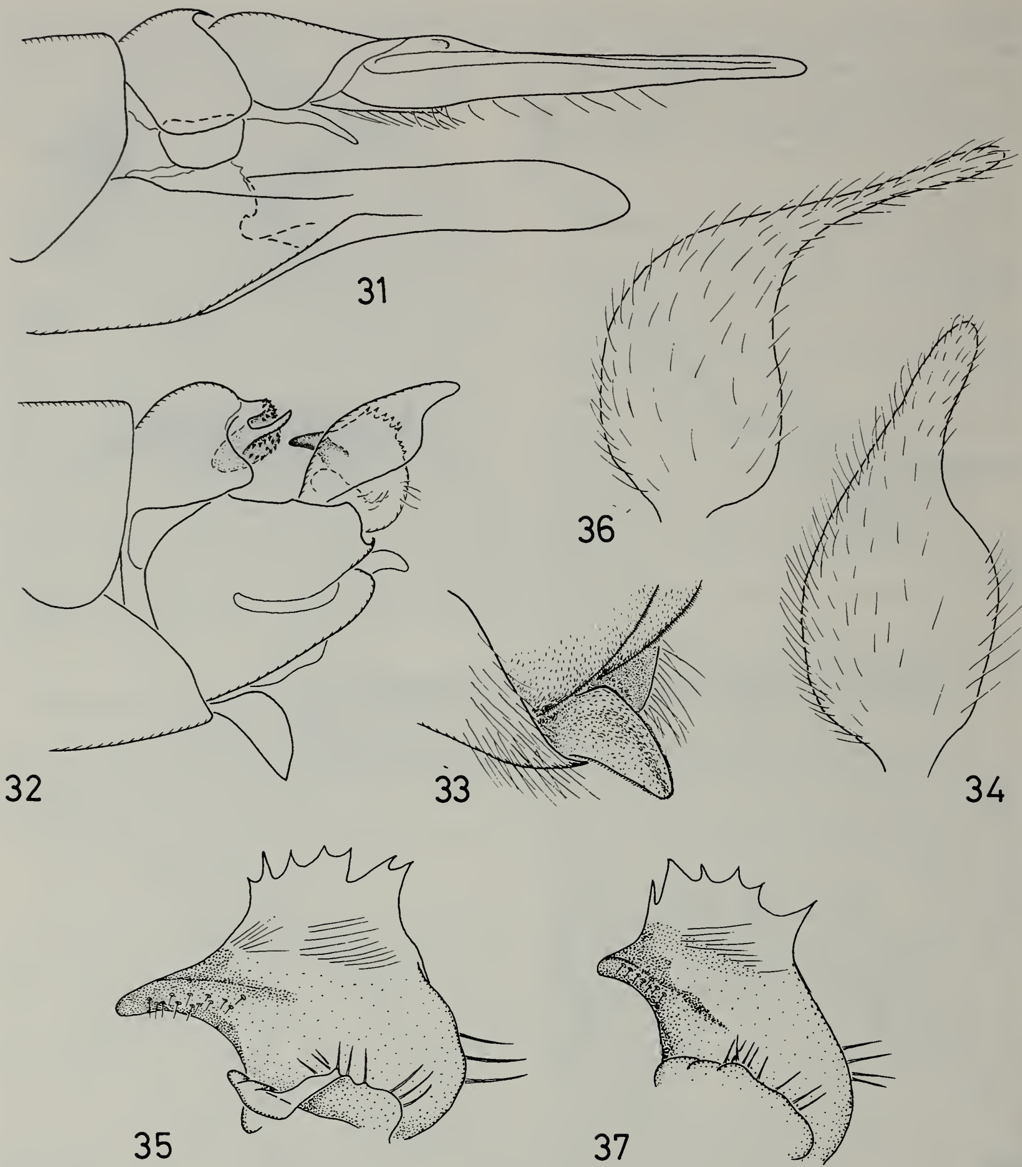
Figs. 25—28. *N. flammeola*. Fig. 25. Hypopygium, lateral view. Fig. 26. Left inner dististyle, from outside. Fig. 27. Extension of male tergite 9, dorsal view. Fig. 28. Male abdomen, showing course of intromittent organ. Figs. 29, 30. *N. parvirostra*. Fig. 29. Extension of male tergite 9, dorsal view. Fig. 30. Adminiculum, lateral view.

moto; Chojabaru, Oita); 1♂, Tsushima; 2♂ 1♀, North Korea (Chonsani near Paiktusan, the highest mountain in Korea, close to the border of Manchuria, appr. 42° N 128° E); 1♂ 4♀, South Korea (16 & 18 mi NE Seoul); 2♂ 4♀, China (Lichuan and Eastern Tombs, Hupeh).

Characteristics. — *N. parvirostra* forms a species group with *daisensis*, *relicta*, and probably also *flammeola*. Apart from the characters mentioned in the key, *parvirostra* males can be



Figs. 31—35. *N. parvirostra*. Fig. 31. Ovipositor, lateral view. Fig. 32. Hypopygium, lateral view. Fig. 33. Medial appendage of male sternite 8, latero-posterior view. Fig. 34. Left outer dististyle, from outside. Fig. 35. Left inner dististyle, from outside. Figs. 36, 37. *N. relicta*. Fig. 36. Left outer dististyle, from outside. Fig. 37. Left inner dististyle, from outside.

easily recognized by the laterally compressed and triangular-shaped midventral appendage of sternite 8 (figs. 32, 33). Outside Japan this character is also found in the closely related species *relicta* (see discussion).

Distribution and period of flight. — Material has been examined from Kunashir, Shikotan, Hokkaido, Honshu, Kyushu, Tsushima, North and South Korea and China (W. Hupeh). Savchenko, and co-authors, in addition report Amur-Zea interregion, southern Sakhalin, and China, Mao-erh-shan (sub *parvirostra*) and southern Khabarovskiy kray and southern Primorye (sub *serristyla*). Early and late records are May 23, June 11 and October 25; all other records are between mid-July and mid-September with a distinct peak at the end of August.

Discussion. — Savchenko (1973) recognizes three subspecies of *parvirostra*, the nominal form, *serristyla* Alexander (1935), and *relicta* Savchenko (1973). Examination of type-material revealed that *serristyla* is synonymous with *parvirostra*. The differences are limited to the coloration of the antennae and thorax and, as such, found among specimens throughout the distribution range, apparently due to variation.

Specimens of *relicta* have the anterior beak of the inner dististyle short (fig. 37), and the outer dististyle apically lengthened (fig. 36). Material of *relicta* was examined from North Korea (Ompo, situated a few miles inland from the coast just south of 42° N), Mongolia (80 km SE Semon Chalchingol), China (Mao-erh-shan; Lichuan; Mt Omei) and USSR (near Irkutsk, syntype ♂, ASL). Material of *parvirostra* was examined from a number of these localities or regions as well. Because of the large area of sympatry, *relicta* is best considered a species instead of subspecies. Savchenko (1973) reports *relicta* from the Leningradskaya oblast, Krasnoyarskiy kray (Mina) and the Irkutskaya oblast.

THE *FUSCESCENS* GROUP

Nephrotoma contrasta Alexander, 1920 (figs. 47—50, 53—54)

Nephrotoma contrasta Alexander, 1920: 23, 24. Ishida, 1955: 120.
Pales contrasta; Savchenko, 1973: 164.

Material examined. — Holotype ♂, in fair condition, antennae, one wing, leg fragments and hypopygium on slide 1129, specimen labelled "Saitama, Japan May 29, 1919 R. Takahashi" "Holotype *Nephrotoma contrasta* C. P. Alexander" (USNMA; Saitama is on Honshu); 1♀ paratype, Hokkaido, Meguro near Horoizumi, 24.v.1919 (USNMA) (the ♀ para(topo)type, USNMA, specimen and slide 1129, belongs to *fuscescens*); other material: 1♀, Hokkaido (Nopporo, Ishikari); 5♂ 3♀, Honshu (Mt Takao; Kyoto).

Characteristics. — Belongs to the *fuscescens* group. The differentiating characters are discussed under *fuscescens*.

Distribution and period of flight. — Known from Hokkaido and Honshu only. On Honshu the species occurs as far South as Kyoto. The records are from May and June.

Nephrotoma flavonota (Alexander, 1914) (figs. 38—42)

Pachyrhina flavonota Alexander, 1914: 158, 159.
Nephrotoma flavonota; Masaki, 1933a: 90. Alexander, 1940a: 121—123. Alexander, 1953c: 148. Ishida, 1955: 121.
Pales flavonota; Savchenko, 1973: 94.

Material examined. — Holotype ♂, three slides only (one with outer and inner dististyle, one with rest of hypopygium, one with a wing), labelled "Holotype 827 *Nephrotoma flavonota* (Alex.) ♂ Tokyo, Japan Aug, 1912 (Ex Kuwana) 827" (USNMA, specimen lost?); 1♀ paratype slide with wing, labelled as the holotype except for „Allotype" and "♀" and not mentioning "(Ex Kuwana)" (USNMA, specimen lost?); other material: 1♂ 2♀, Hokkaido (Meguro near Horoizumi); 2♂ 1♀, Tsushima; 21♂ 13♀, Honshu; 6♂ 6♀, Kyushu; 4♂ 1♀, Shikoku; 7♂ 1♀, China (Chekiang; Fukien).

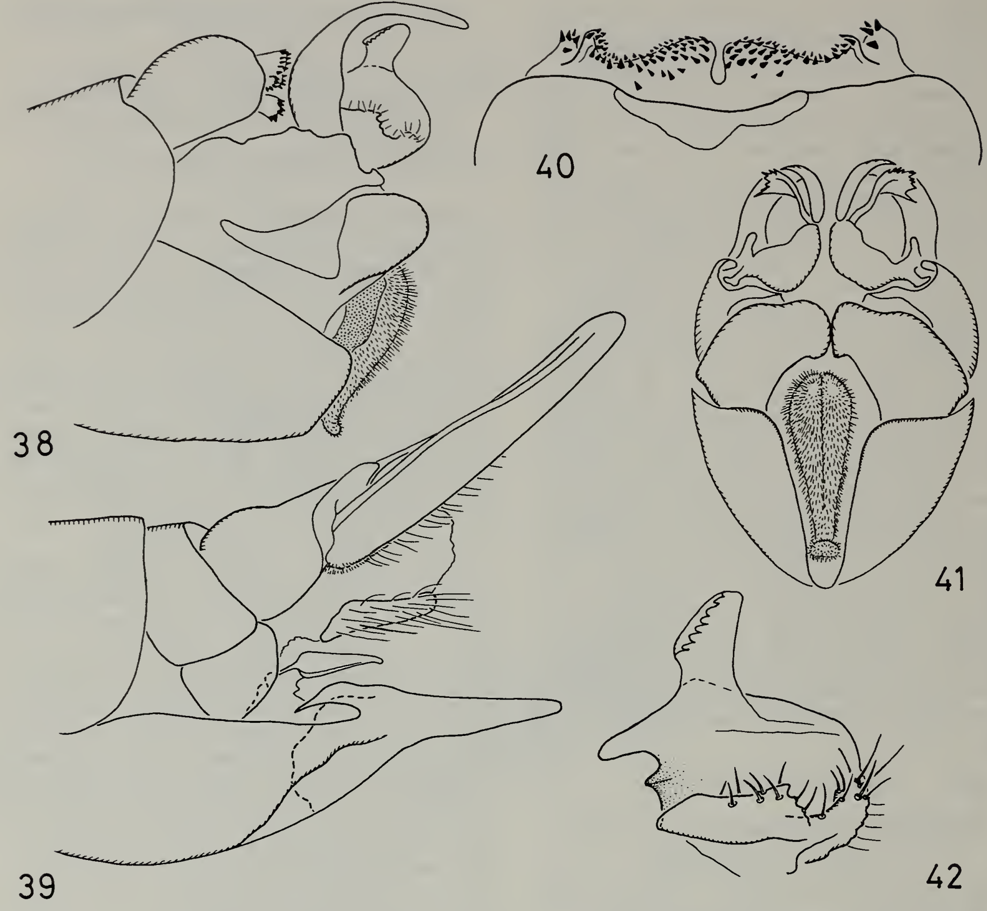
Characteristics. — Head and thorax entirely yellow to brownish yellow, the latter with the dorsal stripes pale brown and subopaque, area between the stripes dull, medial stripe on scutum 1 sometimes with a narrow dull medial line, lateral stripes on scutum 1 straight. Abdomen with a row of dorsal spots, elongate in the male, more triangular in the female. Male segment 8 and tergite 9 darkened. Male tergite 8 deeply incised, incision lined with long hairs; medisternal appendage of sternite 9 elongate, strongly hirsute and occupying incision of sternite 8 (figs. 38, 41). Extension of male tergite 9 as in fig. 40. Inner dististyle with a high serrate crest (fig. 42). Female ovipositor relatively short (fig. 39).

The species does not clearly belong to a species group but might be allied to the *fuscescens* group with which it shares the lengthened male sternite 8, the hirsute medisternal appendage, and the short ovipositor (extremely short in the *fuscescens* group).

Distribution and period of flight. — Known from the Japanese islands Tsushima, Honshu, Kyushu and Shikoku and from the Chinese provinces Chekiang and Fukien. Japanese records are from May 7 to June 18, Chinese records from April 6 to June 11.

Nephrotoma fuscescens (Riedel, 1910) (figs. 43—46, 51—52)

Pachyrhina fuscescens Riedel, 1910: 422, 423.
Pales fuscescens; Savchenko, 1973: 50, 51.
Nephrotoma iyoensis Alexander, 1953d: 226, 267. (**Syn. nov.**)
Pales iyoensis; Savchenko, 1973: 51.



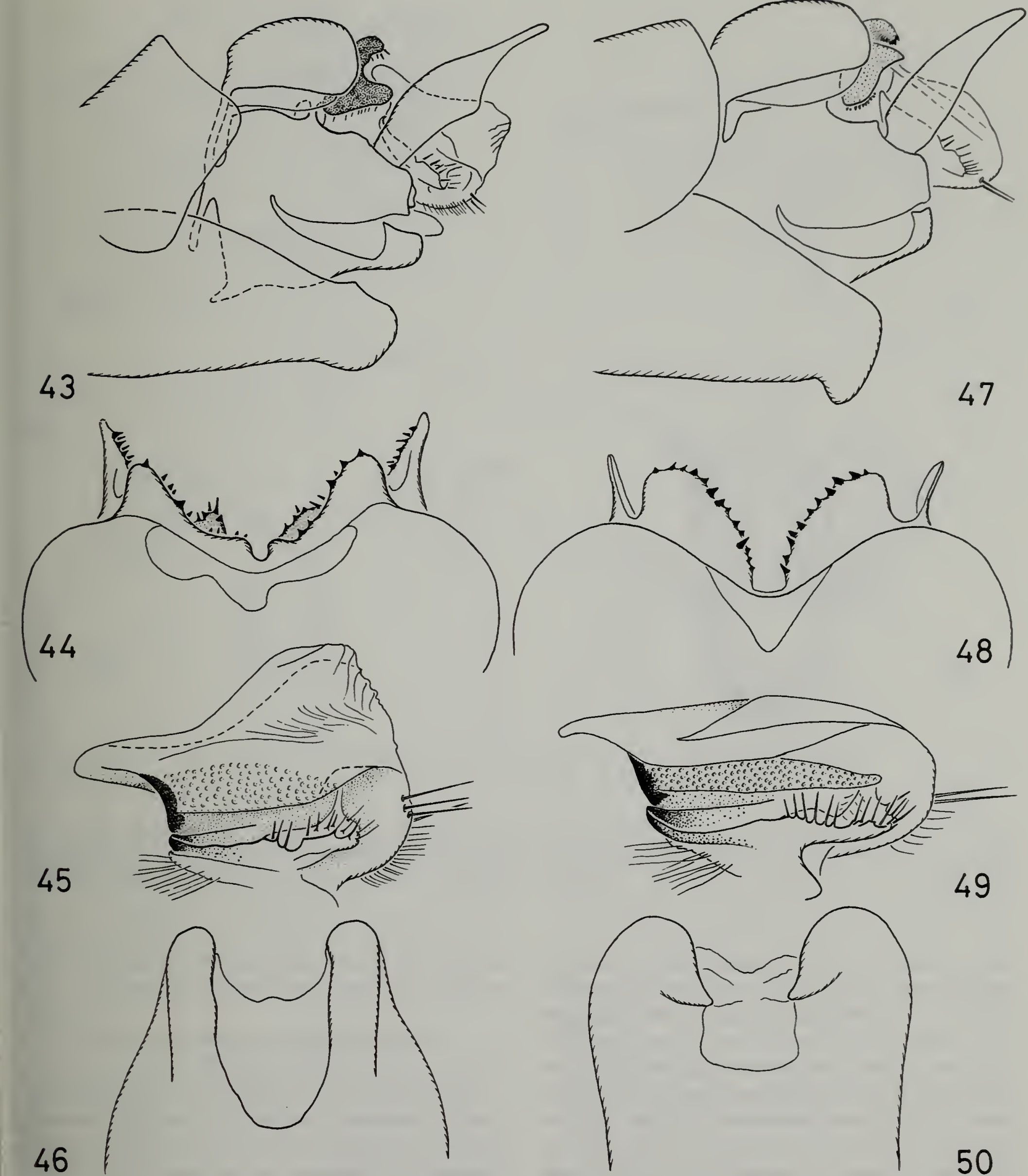
Figs. 38—42. *N. flavonota*. Fig. 38. Hypopygium, lateral view. Fig. 39. Ovipositor, lateral view. Fig. 40. Extension of male tergite 9, dorsal view. Fig. 41. Hypopygium, rear view. Fig. 42. Left inner dististyle, from outside.

Nephrotoma akitae Alexander, 1955: 366—368. (**Syn. nov.**)

Material examined. — Holotype ♂ of *iyoensis*, in fair condition, hypopygium on slide 9706, specimen labelled: "Japan Shikoku Saragamine 1200 m. vi-3.52 Ishihara" "Holotype ♂ *Nephrotoma iyoensis* C. P. Alexander" (USNMA); 1♀ paratype, Shikoku, Saragamine, 1100 m, 3.vi.1952 (USNMA). Holotype ♂ and paratype ♀ of *akitae* on one pin, abdominal ends lacking (corresponding slides were not found), labelled "Japan Akita Prov. Yuze 250 m, vi-22, 51 Issiki-Ito" "Holotype *Nephrotoma akitae* C. P. Alexander" "Allotype *Nephrotoma akitae* C. P. Alexander" (USNMA); other material: 4♂ 2♀, Primorskiy kray (Wladiwostok; Khasan, Kedrova Pad); 1♂ 1♀, Tsushima; 3♀, Honshu (Sata; Saitama; Mt Takao); 15♂ 6♀, Kyushu; 1♂ 1♀, Shikoku (Omogo Valley, Iyo).

The type-material of *fuscescens* ("2♂ 4♀, Halbinsel Jankowsky, Süd Ussuri", Museum für Naturkunde, Berlin, East Germany), could not be studied. The species is described from southern Primorye; material from that region was examined during this study.

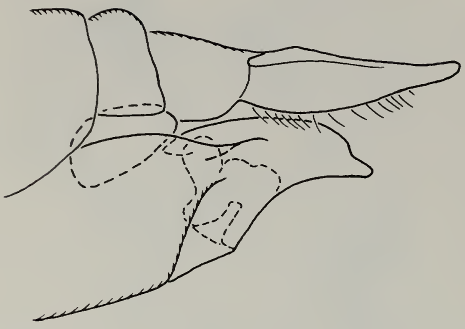
Characteristics. — *N. fuscescens* and the closely related species *contrasta* and *leeuweni* share the following characters: anterior part of mediotergite yellow; lateral thorax with dark brown to black markings; male sternite 8 lengthened and incised (figs. 43, 46, 47, 50, 55, 57); female ovipositor very short (figs. 51—54) (the female of *leeuweni* is unknown, the hypo-



Figs. 43—46. *N. fuscescens*. Fig. 43. Hypopygium, lateral view. Fig. 44. Extension of male tergite 9, dorsal view. Fig. 45. Left inner dististyle, from outside. Fig. 46. Male sternite 8, ventral view. Figs. 47—50. *N. contrasta*. Fig. 47. Hypopygium, lateral view. Fig. 48. Extension of male tergite 9, dorsal view. Fig. 49. Left inner dististyle, from outside. Fig. 50. Male sternite 8, ventral view.

pygium of this species is very similar to that of *fuscescens* and *contrasta* and it is assumed that the same applies to the ovipositor).

The species differ among each other as follows: in *leeuweni* the posterior part of the inner dististyle is enlarged and blackened (fig. 58) and the broadly V-shaped extension of the male tergite 9 possesses robust lateral projections (fig.



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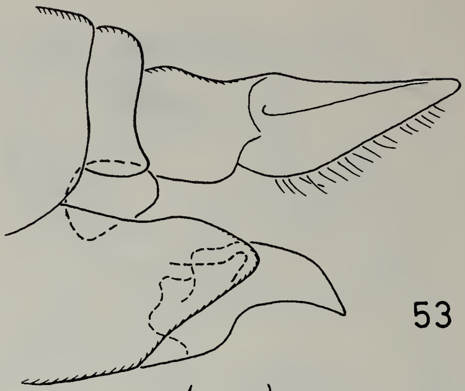

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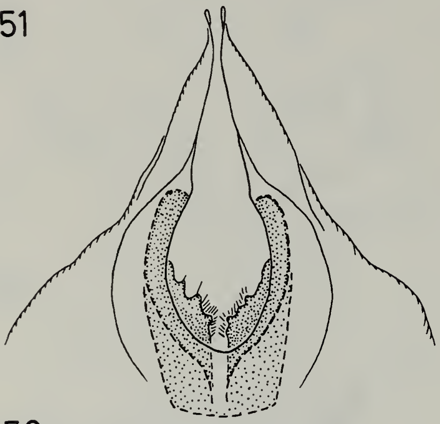

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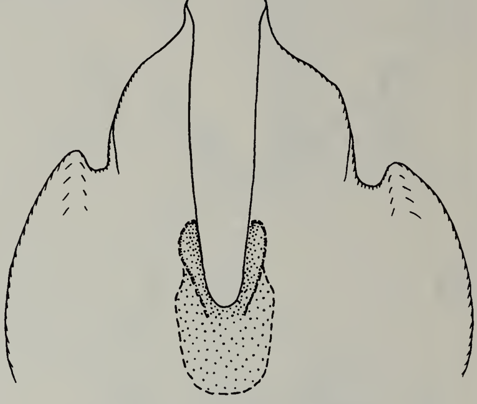

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Figs. 51, 52. *N. fuscescens*. Fig. 51. Ovipositor, lateral view. Fig. 52. Female sternite 8 and hypovalvae, ventral view. Figs. 53, 54. *N. contrasta*. Fig. 53. Ovipositor, lateral view. Fig. 54. Female sternite 8 and hypovalvae, ventral view.

56); in *fuscescens* the extension has a concave medial incision (fig. 43); in *contrasta* the medial incision is convex (fig. 48); the inner dististyle of *fuscescens* has a high posterior crest (fig. 45); in *contrasta* the crest is low (fig. 49); furthermore there are some differences in the ventral aspect of the male sternite 8 (figs. 46, 50); females of *fuscescens* and *contrasta* differ in the shape of the short hypovalvae (figs. 51, 53, with a small dorsal notch before apex in *fuscescens*) and by the transition of sternite 8 and the hypovalvae (figs. 52, 54).

Distribution and period of flight. — Known from southern Primorye and the Japanese islands Tsushima, Honshu, Kyushu and Shikoku. On Honshu the species is sympatric with *contrasta* and *leeuweni* and known as far north as Yuze, Akita. Altitudes are up to 1200 metres. Almost all Japanese records are in May, a few are from June; the records from southern Primorskiy kray are from June and July.

Nephrotoma leeuweni spec. nov.
(figs. 55—58)

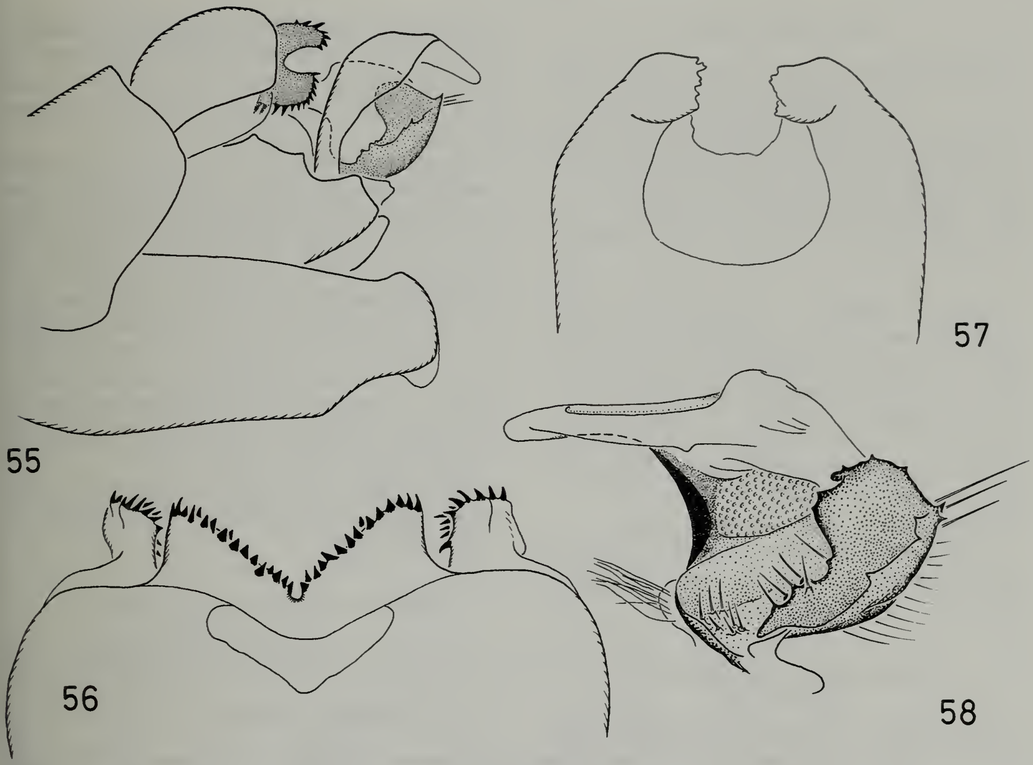
Type-material. — Holotype ♂, in good condition, abdomen stored in microvial, labelled "Honshu Nagano Tokyo, 12.v.1922 Esaki" "Holotype *Nephrotoma leeuweni* P. Oosterbroek" (ZMA).

Characteristics. — Belongs to the *fuscescens* group. Differentiating characters are discussed under *fuscescens*. The most salient character is the enlarged and blackened posterior margin of the inner dististyle (fig. 58).

Description.

Body and wing length: 14 mm.

Head. — Yellow with dorsal part of rostrum and occipital marking dark brown. The latter



Figs. 55—58. *N. leeuweni*. Fig. 55. Hypopygium, lateral view. Fig. 56. Extension of male tergite 9, dorsal view. Fig. 57. Male sternite 8, ventral view. Fig. 58. Left inner dististyle, from outside.

large, about as broad as dorsal pronotum and reaching base of tubercle. In between tubercle and eye margin rounded, dark brown to black spots. Antennae 13-segmented; scape light brown; pedicel brown; flagellar segments dark brown to black and somewhat reniform beyond first; longest verticillar hairs about as long as segments.

Thorax. — Yellow with dark brown to black dorsal stripes and large lateral markings. Lateral stripes on scutum 1 outcurved, the outcurved part dull and reaching halfway paratergite. Anterior two-thirds of mediotergite yellow, posterior one-third with two rounded dark brown spots. Coxae with dark brown markings basally, largest on coxae one; trochanters yellowish brown; femora basally yellowish brown, gradually darkening towards brown tips; tibiae light brown to dark brown; tarsi dark brown; claw of right front leg toothed, other claws lacking. Wing with a light brown tinge, cells c and sc slightly more brownish; stigma distinct, brown, with about 6 macrotrichia; crossveins just below stigma with a brown seam; wingtip clouded brown.

Abdomen. — Yellowish brown with a brown to dark brown dorsal stripe on tergites 1—6, stripe about as broad as scutellum and narrowly interrupted on the anterior part of the tergites; segment 7 and 8 largely darkened.

Hypopygium. — Dark reddish brown. Extension of tergite 9 widely V-shaped with robust lateral projections (fig. 56). Outer dististyle slender (fig. 55). Inner dististyle as in fig. 58, with an elongate and slender anterior beak and the posterior part distinctly enlarged and blackened. Medisternal appendage of sternite 9 strongly hirsute and situated between the lateral extensions of the elongate sternite 8.

Distribution. — Known after the holotype ♂ from Honshu only.

Etymology. — The species is named after my friend and colleague Dr. Br. Theowald van Leeuwen.

The *analis* group

Nephrotoma ozenumensis Alexander, 1925
(figs. 65—68)

Nephrotoma ozenumensis Alexander, 1925b: 399, 400. Masaki, 1933a: 92. Ishida, 1955: 122.
Nephrotoma lamellata; Savchenko, 1970: 120, 121.
Pales ozenumensis; Savchenko, 1973: 162, 163.
Pales sublamellata; Savchenko, 1973: 56—58 (in part).

Material examined. — Holotype ♀, in good condition, one wing on slide 2845, specimen labelled: "Ozenuma Japan 6454 ft vii-25.'23 T. Esaki" "Holotype *Nephrotoma ozenumensis* C. P. Alexander" (USNMA; Ozenuma is on Honshu); other material: 1♂, Shikotan, 20.viii.1971 (ZMA); 1♂, Honshu, Nikko, Tochigi pref., 26.vii.1973 (KURU).

Characteristics. — See under *N. vana*.

Distribution and period of flight. — Known from Shikotan and Honshu only. Records are from July 17 to August 20.

Nephrotoma vana spec. nov.
(figs. 59—63)

Introduction. — In the literature some confusion exists about the synonymy of *sublamellata* Alexander, 1935, and *lamellata* (Riedel, 1910). Examination of the male holotype of the former (USNMA) revealed that *sublamellata* is at most a subspecies of *lamellata*, differing in the shape of the lateral appendage of the adminiculum only, and replacing *lamellata* in southern Primorye, Sakhalin and North Korea. Examination of specimens from the Kurile and Japan showed that this material belongs to two other species, closely related to *lamellata*. They are *ozenumensis* Alexander, 1925, known from Shikotan and Honshu; and *vana* nov. spec., divided here into two subspecies, the nominal form from Kunashir and Hokkaido, and the subspecies *nigrovana* from Honshu and Kyushu.

Characteristics. — The species *lamellata*, *ozenumensis* and *vana* do not differ in coloration, except for the darker coloured subspecies *nigrovana* (see descriptions of *vana vana* and *vana nigrovana*). The differences are limited to hypopygial characters as follows:

lamellata: gonapophyses of the adminiculum with an acute upright projection (fig. 64); in the subspecies *sublamellata* the downcurved posterior arm is notably shorter;

ozenumensis: gonapophyses of the adminiculum without an acute upright projection and posterior arm not downcurved (fig. 66); in both *lamellata* and *ozenumensis* the dorsal margin of the appendage is serrate; outer dististyle sinuate with the apical part very slender and elongate (fig. 65);

vana: gonapophyses of the adminiculum more straight and with the dorsal margin not serrate (fig. 62); outer dististyle less sinuate (fig. 63); lateral shells of the extension of tergite 9 in dorsal view largely concealed by the above-lying flanges (fig. 61), in *lamellata* and *ozenumensis* these flanges are less developed (fig. 67); *vana nigrovana* differs from the nominal subspecies in coloration only: the thorax is almost entirely darkened, the scutal stripes are broadly in contact with each other and the abdominal segments (5) 6—8 are entirely black.

Etymology. — The name *vana* refers to the more hollow lateral shells of the extension of the male tergite 9.

Nephrotoma vana vana subsp. nov.
(figs. 59—63)

Pales lamellata; Savchenko & Krivolutzkaya, 1966: 56.
Pales sublamellata; Savchenko, 1973: 56—58 (in part).
Nephrotoma lamellata; Oosterbroek, 1980: 366 (subsp. nov.; distribution only).

Type-material. — Holotype ♂, in good condition, labelled "Japan Murayama Sapporo vi-25.'32 Okada (USNMA); paratypes: 1♂, Kunashir, 1.viii.1977 (ZMA); 1♂, Hokkaido, Jozankei, Sapporo, 19.viii.1922 (ZMA); 1♀, idem, 28.vi.1953 (USNMA); 1♀, Hokkaido, Yubaridake, subalpine z., 14.vii.1967 (KU).

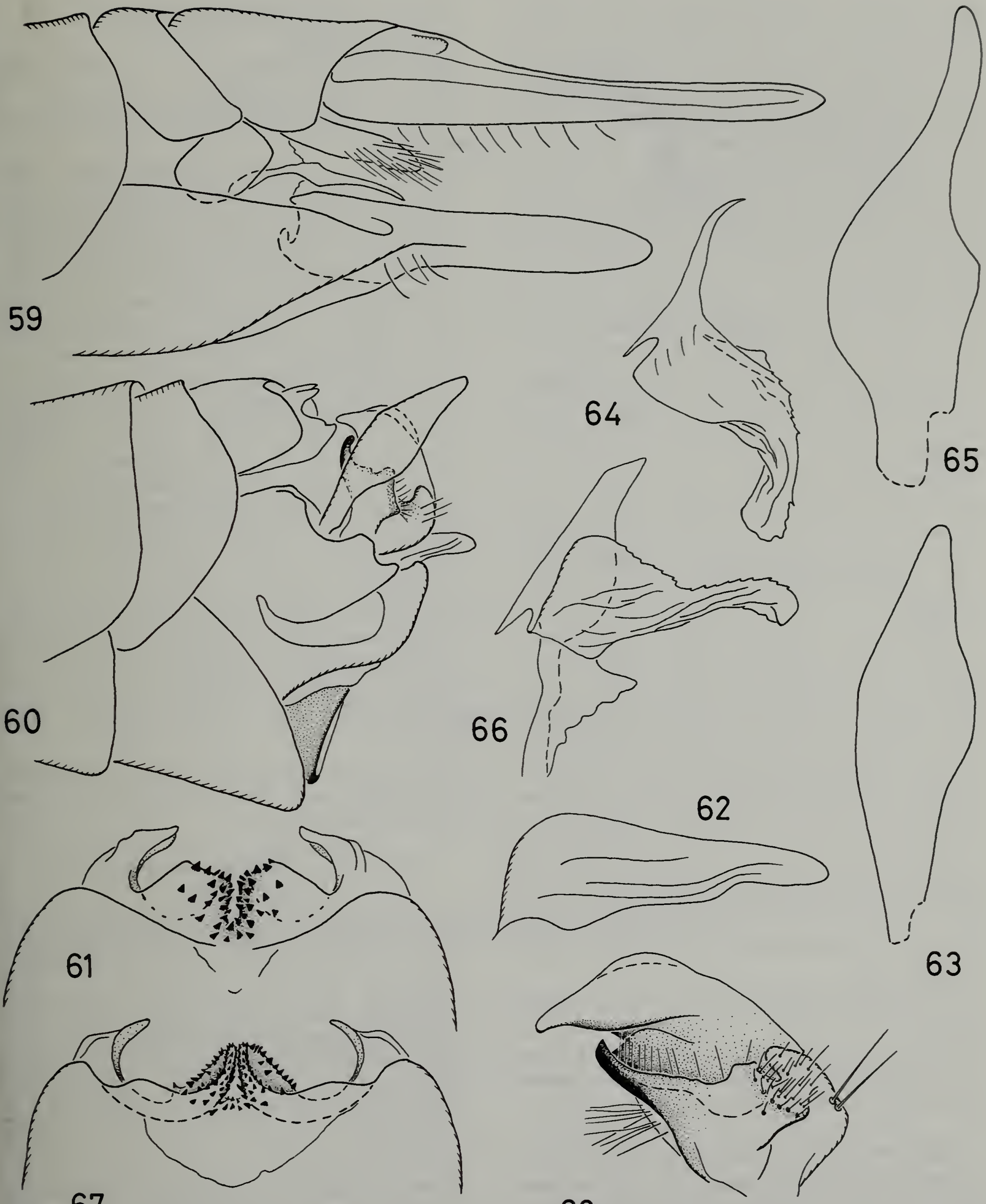
Characteristics. — See under *N. vana*.

Description.

Body length ♂: 12—13 mm, ♀: 18—20 mm; wing length ♂: 12—13 mm, ♀: 15—17 mm.

Head. — Dorsal part of rostrum broadly dark brown, lateral parts yellow. Head pale yellow to yellow, tubercle and vertex sometimes more brownish. Occipital marking large, about as broad as or broader than dorsal part of pronotum, with rounded lateral margins and usually pointed anteriorly, reaching base of tubercle. Next to tubercle large dark brown spots along eye-margin. Antennae with 13 segments; scape yellow with brownish patches on apical half; pedicel light brown; flagellar segments dark brown, in the male somewhat nodulose basally beyond first, in the female cylindrical.

Thorax. — Pronotum dorsally yellow, lateral



Figs. 59—63. *N. vana vana*. Fig. 59. Ovipositor, lateral view. Fig. 60. Hypopygium, lateral view. Fig. 61. Extension of male tergite 9, dorsal view. Fig. 62. Left gonapophyses, lateral view. Fig. 63. Left outer dististyle, from outside. Fig. 64. *N. lamellata*. Adminiculum and left gonapophysis, lateral view. Figs. 65—68. *N. ozenumensis*. Fig. 65. Left outer dististyle, from outside. Fig. 66. Adminiculum and left gonapophysis, lateral view. Fig. 67. Extension of male tergite 9, dorsal view. Fig. 68. Left inner dististyle, from outside.

part anteriorly yellow to light brown, posteriorly dark brown. Scutal stripes dark brown to black, lateral stripes with the outcurved anterior part dull and large, almost or actually reaching paratergite. Dull seam around anterior corners of scutum 2 occupying lateral part of transverse suture and contacting lateral stripes of scutum 1 with stripes of scutum 2. Scutellum yellowish brown with a broad brown to dark brown medial stripe or scutellum entirely darkened. Mediotergite antero-laterally yellowish brown, antero-medially with a broad brown to dark brown stripe which distinctly broadens posteriorly. Lateral parts of thorax yellowish brown, variegated with large dark brown markings. Coxae dorsally darkened; trochanters largely light brown; femora light brown with the apices broadly darkened, front legs with apical half darkened; tibiae and tarsi brown to dark brown; male claws toothed. Wings with a light brownish yellow tinge; stigma dark brown with about 30 macrotrichia; crossveins just below stigma with a broad brown seam; wingtip broadly clouded.

Abdomen. — Tergite 1 with a broad brown to dark brown spot dorsally. Tergites 2—5 (male) or 2—6 (female) with brown to dark brown spots on the posterior part of the tergite, in the male spots about as large as scutellum and on tergite 2 prolonged anteriorly to contact similar spot on anterior half of the tergite, in the female spots broader and more triangular and prolonged anteriorly forming a continuous stripe. Sternites 1—5 or 1—6 yellow. Male with segments 6—8 and female with segments 7—8 dark brown to black. Hypopygium largely darkened. Female tergites 9 and 10 and ovipositor light brown.

Hypopygium and ovipositor. — As in figs. 59—63.

Distribution and period of flight. — Known from Kunashir and Hokkaido only. The records are between June 25 and August 19.

Nephrotoma vana nigrovana subsp. nov.

Type-material. — Holotype ♂, in good condition, abdomen stored in microvial, labelled "Honshu Mt Hirasan Shiga pref. 900—1100 m. 1969.vi.5 K. Kanmiya" (KURU); paratypes: 1♀, Kyushu, Shiratoriyama, Kumamoto, 10.vii.1977 (KU); 1♀, Kyushu, Bogazuru, Kujusan,` 13.vi.1968 (ZMA); 1♀, Japan, 1909 (BMNH); 1♀, Honshu, Chugokusanchi, Kamikochi, 5000′, 26.vii.1939 (ZMA).

Characteristics. — See under *vana*.

Description.

Body length ♂: 15 mm, ♀: 18—20 mm; wing length ♂: 14 mm, ♀: 16 mm.

Head. — As in the nominal form, pedicel and scape darker.

Thorax. — Thorax and coxae largely dark brown to black. Scutal stripes broadly in contact with each other; lateral stripes of scutum 1 with a large dull outcurved anterior part. Thorax yellow or yellowish brown at dorsal pronotum, on either side of outcurved part of the lateral stripe of scutum 1, at paratergite and with smaller marks around wing base, largest on katepisternite. Wings and legs as in *vana vana*.

Abdomen. — Segment 1 dark brown to black, the tergite laterally somewhat lighter. Segments 2—4 yellow, the tergites with dark brown triangular transverse bands along the hind margin, bands in male relatively narrow, in female broader, dorsally occupying posterior half of tergite; tergite 2 in addition with a rounded dark brown to black spot on anterior half with two smaller spots antero-laterad of it. Anterior part of sternite 5 yellow, remainder of segment 5 dark brown to black. Segments 6—8 and male hypopygium dark brown to black. Female tergites 9 and 10 and ovipositor light brown.

Distribution and period of flight. — Known from Honshu and Kyushu only. Records are from June 5 to July 26.

Nephrotoma pullata (Alexander, 1914)
(figs. 69—72)

Pachyrhina pullata Alexander, 1914: 160—162.

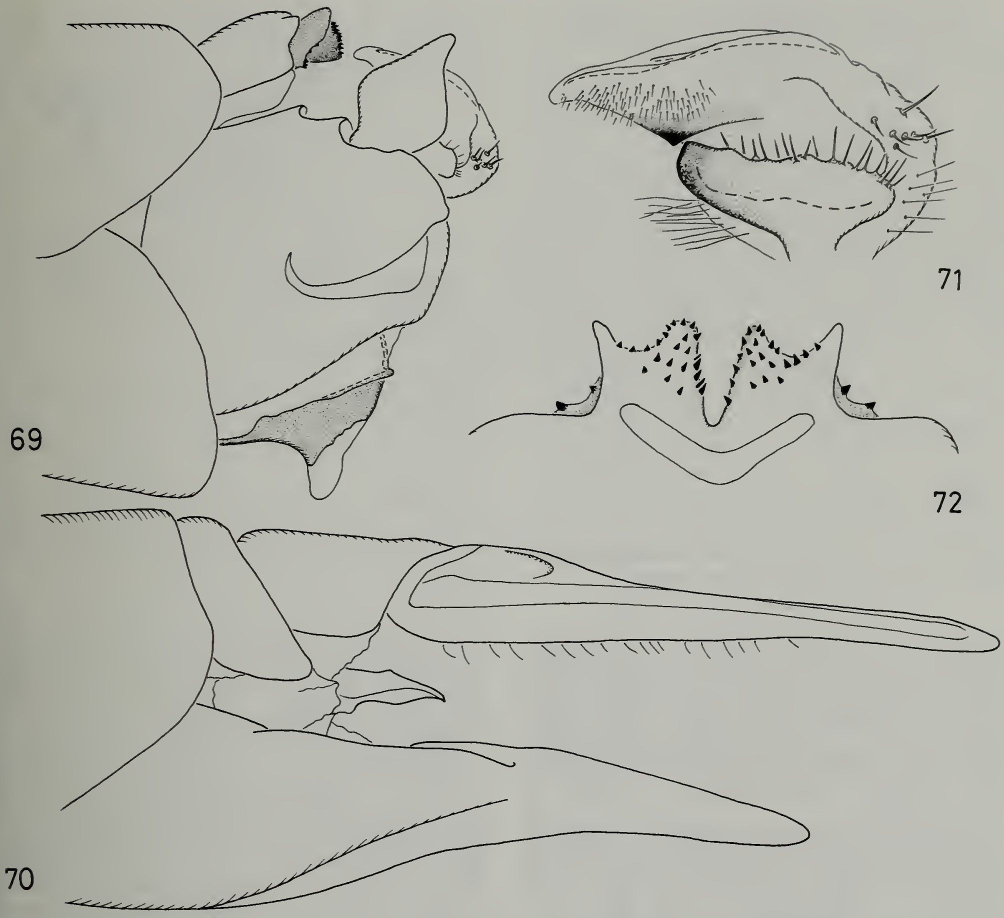
Nephrotoma pullata; Masaki, 1933a: 90. Alexander, 1953a: 73. Alexander, 1953c: 148, 149. Ishida, 1955: 123.

Nephrotoma hokkaidensis Alexander, 1925a: 446, 447. (Synonymy in Alexander, 1953c.)

Nephrotoma mannheimsi Savchenko, 1966: 260—262. (**Syn. nov.**)

The reference by Savchenko (1973) refers to *neopratensis*.

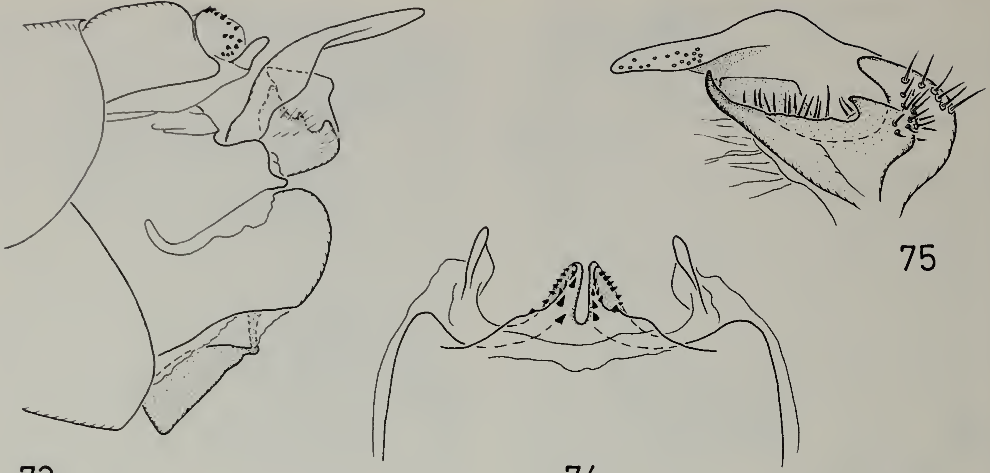
Material examined. — Holotype ♂ of *pullata*, three slides containing one wing, left inner and outer dististyle and abdominal end, labelled "Holotype 829 *Nephrotoma pullata* (Alex.) ♂ Tokyo, Japan May 7, 1912 (Ex S. Kuwana) 829" (USNMA, the holotype specimen was not found). Holotype ♂ of *hokkaidensis*, in good condition, labelled "Yoichi, Prov. Shiribeshi, Japan vi-26-1921 S. Kuwayama" "Holotype



Figs. 69—72. *N. pullata*. Fig. 69. Hypopygium, lateral view. Fig. 70. Ovipositor, lateral view. Fig. 71. Left inner dististyle, from outside. Fig. 72. Extension of male tergite 9, dorsal view.

Nephrotoma hokkaidensis C. P. Alexander" (USNMA; Yoichi is, of course, on Hokkaido); paratypes: 1♂ 1♀, para(topo)types (USNMA); 2♂, Hokkaido, Sapporo. Mt Moiwa, 15.vi.1923 (1♂ USNMA, 1♂ BMNH); 1♂ 1♀, Hokkaido, Sapporo, 15.vi.1921 (USNMA, with slide 829); 1♂, idem, end vi.1921 (USNMA). Holotype ♂ of *mannheimsi*, in good condition, labelled "Maoershan, Mandschurei 7.vii.39 W. Alin leg." "Mandschurei, Maoershan 7.vii.39 W. Alin" "*Pales* sp. n. opr. E. N. Savchenko" "Holotypus *Pales mannheimsi*, sp. n. Savtshenko" (MAK; notwithstanding the type-labels, the species was described in *Nephrotoma*); paratypes: 1♂ 1♀, para(topo)types from 23.vi.1939 (MAK); other material: 14♂ 18♀, Hokkaido; 3♂ 4♀, Honshu; 1♂ 1♀, Kyushu (Kagoshima; Beppu); 1♀, Sado; 3♂ 2♀, North Korea (Ompo, situated a few miles inland from the coast just South of 42° N; Seren Mts); 1♂ 1♀, China (Manchuria: Mao-erh-shan and Erzendjanzsy).

Characteristics. — *N. pullata* is a large species (body length ♂ up to 19 mm, ♀ up to 24 mm). The coloration of the head is characteristic with the yellow eye-ring broadly interrupted by the greyish lateral extension of the occipital marking. The lateral thorax is dusted grey to a variable degree. The male abdominal tergites 2—5 with elongate, brown to black, dorsal spots in front of hind margin, usually about as broad as scutellum and twice as long; posterior segments blackened. Female with a continuous dorsal stripe on tergites 2—7, composed of triangular spots, largest on tergites 4—6; tergites



Figs. 73—75. *N. stygia*. Fig. 73. Hypopygium, lateral view. Fig. 74. Extension of male tergite 9, dorsal view. Fig. 75. Left inner dististyle, from outside.

laterally and sternites ventrally with elongate brown to dark brown spots. Specimens from the continent are usually to a much lesser degree variegated with brown to black markings, especially on the abdomen, and they have the thorax not dusted grey. Hypopygium and ovipositor as in figs. 69—72.

Distribution and period of flight. — Material was examined from Hokkaido, Honshu, Sado, Kyushu, Shikoku, North Korea and China (Manchuria). Savchenko (1966) in addition reports Amurskaya oblast and Primorskiy kray. On the continent and on Hokkaido the species is on the wing from the end of May until the end of July, on the other Japanese islands the records are much earlier, from mid-April to mid-June, with one record for August 9.

Nephrotoma stygia Alexander, 1921
(figs. 73—75)

Nephrotoma stygia Alexander, 1921: 131, 132. Alexander, 1925c: 4. Esaki, 1932: 181. Masaki, 1933a: 91. Ishida, 1955: 124.

Pales erebus; Savchenko, 1973: 113 (see discussion).

Material examined. — Holotype ♂, in good condition, one wing on slide 1788, specimen labelled "Ikaho, Japan Gumma-ken, July 7 1920 K. Tanaka" "Holotype *Nephrotoma stygia* C. P. Alexander" (USNMA; Ikaho is on Honshu); paratypes: 1♀, in poor condition, one wing on slide 1788, specimen labelled as the holotype; 1♀, Honshu, Chuzenji, 9.vii.1920 (both ♀ USNMA); other material: 1♂ 5♀, Hokkaido (Sounkei; Sapporo; Shizunai); 11♂ 15♀, Honshu; 1♂, Shikoku (Mt Sara).

Characteristics. — *N. stygia* is an almost completely brownish black species with two, clear yellow marks on the lateral thorax, namely the membranous area underneath the paratergite and the anterior half of the katatergite in front of the halter. The genae and frontal tubercle are more brownish yellow than the rest of the head. The abdominal segments are shining with a broad dull ring along the posterior margins. *N. stygia* belongs to the *analis* subgroup (sensu Oosterbroek, 1980), as is shown by the shape of the inner dististyle (fig. 75) and the extension of tergite nine (fig. 74). The basal one-third of the intromittent organ is relatively thick, the apical two-thirds are more slender and consist of a cylindrical filament which is dorsally open, especially at the transition; a similar opening is found in the *flavipalpis* subgroup, the presumed sistergroup of the *analis* subgroup (Oosterbroek, 1980).

Distribution and period of flight. — Known from the islands Hokkaido, Honshu and Shikotan; Masaki and Ishida also mention Kyushu, but no material from that island was examined. The species is recorded from altitudes up to 2000 m and is most frequent from the end of July until the end of August, only a few records are from early July.

Discussion. — Savchenko (1973) considers *stygia* as possibly a junior synonym of *erebus*, but *stygia* is a valid species, not even belonging to the same species-group as *erebus*.

THE *PALLORIS* GROUP

Nephrotoma bifusca Alexander, 1920
(figs. 79—83, 88, 91)

Nephrotoma bifusca Alexander, 1920: 25, 26. Alexander, 1953d: 265, 266. Ishida, 1955: 120.
Pales bifusca; Zinovjev & Savchenko, 1962: 557, 569. Savchenko, 1973: 45, 46.

Material examined. — Holotype ♀, in good condition, one wing on slide 1128, specimen labelled "Kioto, Japan May 27, 1914 A. Nohira" "Holotype *Nephrotoma bifusca* C. P. Alexander" (USNMA); other material: 3♂ 2♀, Honshu (Tottori, Owami, Gifu); 2♂, Shikoku (Minara; Iyo); 2♂, North Korea (Puksu Pyaksan in Kankyo Nando, the second highest peak in Korea, appr. 40° 40′ N 127° 45′ E; Chonsani near Paiktusan, the highest mountain in Korea, close to the border of Manchuria, appr. 42° N 128° E); 4♂ 6♀, South Korea (Central Nat. Forest, 18 mi NE Seoul; 8 mi SW Kangnung; Tangjok-gok, 38°11′N 128°19′E); 2♂ 3♀, Primorskiy kray (Khasan, Kedrova Pad; Wladiwostok); 1♂, Khabarovskiy kray (Khabarovsk); 1♂ Amurskaya oblast (Khor).

Characteristics. — *N. bifusca* belongs to the *palloris* group, of which the Japanese species possess an usually isolated dull mark below the anterior end of the lateral stripes on scutum 1 and which have the lateral parts of the mediotergite darkened and the antero-medial part yellow. Among these species *bifusca* can be easily recognized by the brown seam along the wing cord and apical part of vein CuA2. Males have the posterior margin of the inner dististyle blackened (fig. 80). In females the dorsal margin of sternite 8 is very high towards the hypovalvae, a character easily visible even in unmacerated specimens (figs. 88, 91). A peculiarity of *bifusca* is the swelling of the intromittent organ at about one-third its length from the semen pump (fig. 82). See also under *palloris*.

Distribution and period of flight. — Known from Amurskaya oblast, Khabarovskiy kray, Primorskiy kray, North Korea, South Korea and the Japanese islands Honshu and Shikoku. The period of flight is from the second half of May until the first half of September.

Nephrotoma geminata Alexander, 1920
(figs. 76, 89)

Nephrotoma geminata Alexander, 1920: 24, 25. Ishisda, 1955: 121.
Pales geminata; Savchenko, 1973: 64.

Material examined. — Holotype ♂, in fair condition, several parts stored on slide 1127, specimen labelled "Ichikawa Chiba-ken Japan v-17-1919" "Holotype *Nephrotoma geminata* C. P. Alexander" (USNMA). 1♀ paratype with slide 1127, labelled as the holotype except "May 17, 19" and "Allotype" (USNMA); other material: 36♂ 15♀, from Honshu.

Characteristics. — Belongs to the *palloris* group and is compared with the species of this group under *palloris*.

Distribution and period of flight. — Known from Honshu only and on the wing from the second half of April to the end of May, with one record for September 9.

Nephrotoma pallida spec. nov.
(figs. 84—87, 90, 92)

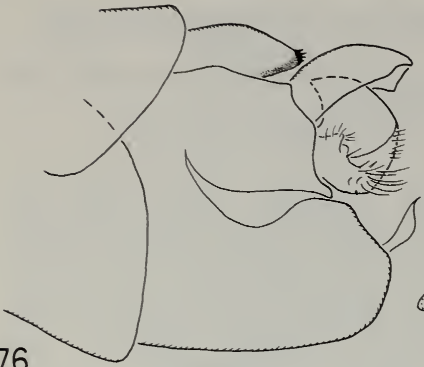
Type-material. — Holotype ♂, in good condition, labelled "Kyushu Miyazaki Miyazaki 3.x.1973" J. Emoto (KU); paratypes: 1♀, labelled as the holotype (ZMA); 1♂, Yakushima, Onoaida, 7.x.1968 (ZMA); 1♂ 1♀, Kyushu, Sata Misaki, 19.v.1952 (♀), 21.v.1952 (♂) (USNMA); 1♂, Yunomoto, Isl. Iki NE of Kyushu, 28.v.1957 (ZMA); 1♀, Kyushu, Sata Oshumi, Magome-Hetsuka, 24.v.1952 (USNMA); 1♂, Kyushu, Inunakiyamo, Fukuoka, 18.viii.1965 (KU); 1♀, Kyushu, Inunakiyamo, Fukouka, 30.ix.1965 (ZMA).

Characteristics. — Closely related to *palloris*, discriminating characters are discussed under that species.

Description.

Body length ♂: 10—11 mm, ♀: 14—16 mm; wing length ♂: 10—11 mm, ♀: 12—13 mm.

Head. — Yellowish, vertex light brown, rostrum usually with a brownish spot dorsally. Occipital marking a small shining triangle with a narrow dark brown frontal prolongation that reaches top of tubercle, frontal prolongation less broad than diameter of flagellomere 1 and sometimes faint or even absent. Antennae 13-segmented; scape, pedicel and first flagellar segment light yellow to brownish yellow; following flagellar segments light brown and somewhat reniform in the male with the basal nodes



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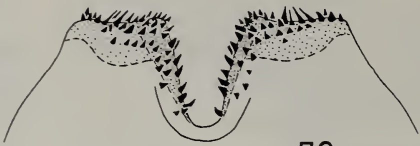

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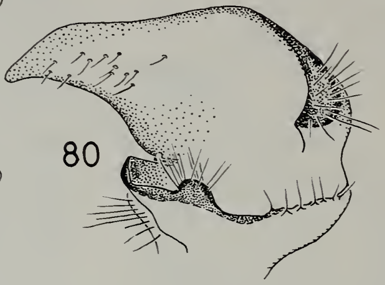

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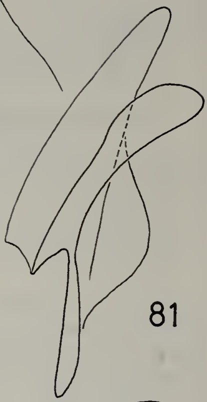

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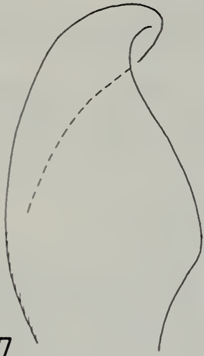

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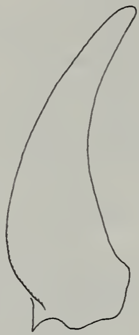

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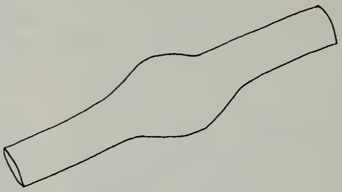

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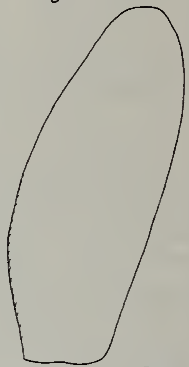

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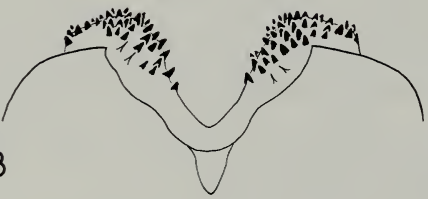

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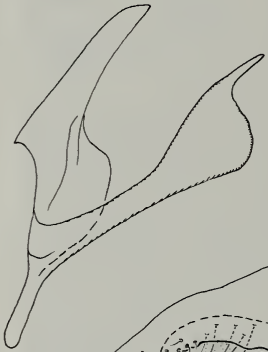

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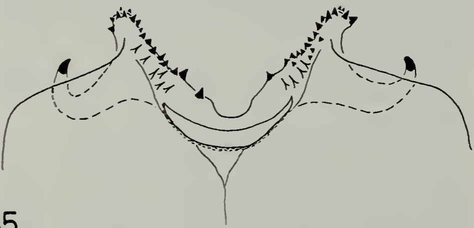

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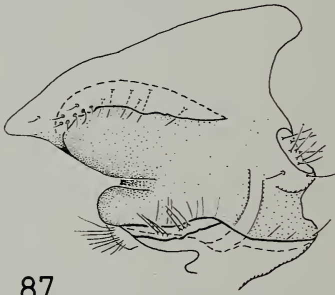

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Fig. 76. *N. geminata*. Hypopygium, lateral view. Figs. 77, 78. *N. palloris*. Fig. 77. Left outer dististyle, from outside. Fig. 78. Extension of male tergite 9, dorsal view. Figs. 79—83. *N. bifusca*. Fig. 79. Extension of male tergite 9, dorsal view. Fig. 80. Left inner dististyle, from outside. Fig. 81. Adminiculum and left gonapophysis, lateral view. Fig. 82. Swelling of intromittent organ. Fig. 83. Left outer dististyle, from outside. Figs. 84—87. *N. pallida*. Fig. 84. Left outer dististyle, from outside. Fig. 85. Extension of male tergite 9, dorsal view. Fig. 86. Adminiculum and left gonapophysis, lateral view. Fig. 87. Left inner dististyle, outside view.

blackened; in the female yellowish with the basal nodes of the segments blackened beyond first or second segment.

Thorax. — Pronotum yellowish brown. Lateral thorax pale yellow to yellow, dorsal part of anatergite dark brown. Scutum 1 and 2 pale yellow to yellowish brown between stripes. Scutal stripes dark brown; anterior half of medial stripe of scutum 1 usually paler with a broad brownish yellow mark along mid-line, mark sometimes extending over entire length of stripe; lateral stripes of scutum 1 straight with a large, isolated, rounded or oval, dull black spot below anterior end. A broad dull black seam around antero-lateral corners of scutum 2. Scutellum transparent, yellow to light brown. Mediotergite yellow on antero-medial part, lateral and posterior parts dark brown. Coxae, trochanters and femora light brown, the latter with narrowly darkened tips; tibiae light brown to brown, tips dark brown; tibiae brown to dark brown; male claws toothed. Wings with a light brown tinge, cell c and usually sc dark brown; stigma dark brown with up to 20 macrotrichia; dark coloration of wing margin usually narrowly continued beyond stigma, broadening towards wingtip and reaching vein M2, sometimes even CuA1.

Abdomen. — Brownish yellow with a row of dark brown dorsal and lateral spots. Tergite 1 broadly dark brown dorsally. Tergites 2—7 with elongate dark brown spots which almost reach preceding tergite, spots in the male about as broad as scutellum, in the female somewhat broader, spots sometimes less developed on tergites 5—7. Tergites 2—8 with elongate dark brown spots along lateral margin, almost forming a continuous stripe, especially on the anterior tergites. Sternites yellow, sometimes infuscated, hind margins light yellow.

Hypopygium. — Extension of male tergite 9 widely V-shaped with slender and curved lateral arms (fig. 85). Outer dististyle very narrow (fig. 84). Inner dististyle with a posterior crest (fig. 87). Gonapophyses elongate, the warning-finger-like part usually visible outside hypopygium (fig. 86), but not as distinct as in *geminata* (fig. 76). Hind margin of sternite 8 with a very wide and shallow incision, lined with long golden hairs.

Ovipositor. — Lateral aspect as in fig. 90 and dorsal aspect of hypovalvae as in fig. 92, differing from *palloris* (fig. 93) among others in the shape of the rostral extensions.

Distribution and period of flight. — Known from the islands Iki, Kyushu and Yakushima only. The species has been collected at the following dates: May 19, 24, 28, August 18, September 30, October 3 and 7.

Etymology. — The name *pallida* has the same meaning as *palloris*, of pale colour. The two species are evidently allopatric sisterspecies.

Nephrotoma palloris (Coquillett, 1898) (figs. 77, 78, 93)

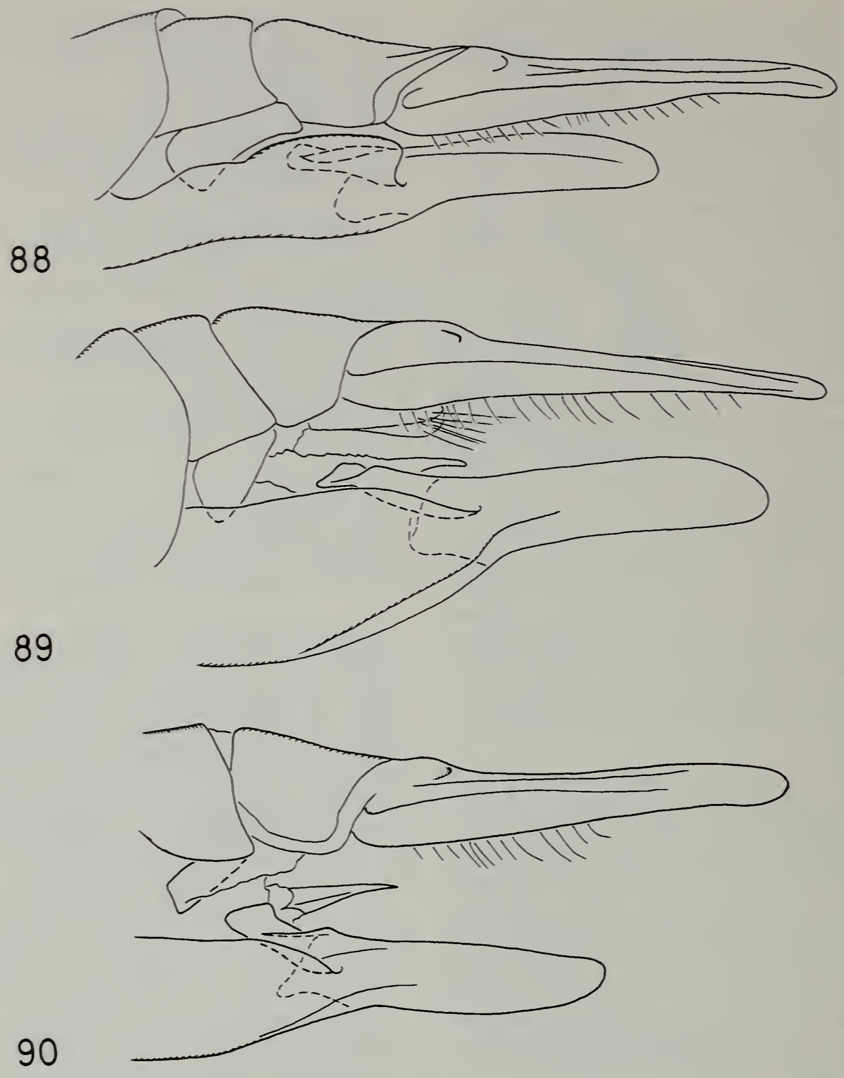
Pachyrhina palloris Coquillett, 1898: 306. Alexander, 1914: 159, 160.
Nephrotoma palloris; Alexander, 1920: 24. Masaki, 1933a: 90. Ishida 1955: 122. Alexander & Alexander, 1973: 36 (in part).
Pales palloris; Savchenko, 1973: 44, 45.
Pales autumnalis Savchenko, 1973: 106, 107 (**Syn. nov.**)
Nephrotoma autumnalis; Savchenko, 1970: 120, 121 (localities only).

The references by Riedel (1917, 1918) and Alexander & Alexander (1973, in part) apparently refer to *sinensis*, see distribution.

Material examined. — *Nephrotoma palloris*: Holotype ♀, in good condition, flagellar segments lacking, labelled "Japan Mitsukuri" "Type no 3968 USNM" "*Pachyrhina palloris* Coq." (USNM; Mitsukuri is presumably on Honshu). *Nephrotoma autumnalis*: 2♂ 2♀ syntypes from Moneron, Violovich, 23.viii.1956 (1♂) and 26.viii.1956 (1♂ 2♀) (ASL; Savchenko, 1973, described *autumnalis* after 9♂ 8♀ from Moneron and 1♂ from Shikotan, without mentioning type-locality and without designation of a holotype); other material: 5♂ 5♀, Hokkaido; 20♂ 16♀, Honshu; 2♂, Oshima.

Characteristics. — Forming a species group with *geminata*, *bifusca* and *pallida* and closely related to the latter. The species are very similar in coloration. Except *geminata*, they usually have the costal margin of the wing darkened as follows: in *bifusca* cell sc is darkened and in *palloris* and *pallida* cells c and sc; this, however, is not a reliable character to separate the species, while *bifusca* can have both cells dark brown, *palloris* both or sc only or neither of the two and *pallida* only sc. More reliable characters are found in the copulatory organs.

Males: Inner dististyle without crest (figs. 76, 80): *bifusca* and *geminata*. Posterior part of inner dististyle blackened (fig. 80): *bifusca*. Gonapophyses distinctly protruding beyond hypopygium (fig. 76): *geminata*. Inner dististyle with a posterior crest (fig. 87): *palloris* and *pallida*. Outer dististyle broad (fig. 77): *palloris*. Outer



Figs. 88—90. Ovipositor, lateral view. Fig. 88. *N. bifusca*. Fig. 89. *N. geminata*. Fig. 90. *N. pallida*.

diststyle slender (fig. 84): *pallida*.

Females: Dorsal margin of sternite 8 distinctly upcurved before contacting hypovalvae (figs. 88, 91): *bifusca*. Cerci slender (fig. 89): *geminata*. Cerci broad (fig. 90): *palloris* and *pallida*. Rostral extensions of hypovalvae broad (fig. 93): *palloris*. Rostral extensions narrower (fig. 92): *pallida*. The differences in the hypovalvae are the only reliable characters found to separate the females of *palloris* and *pallida*.

Distribution and period of flight. — *N. palloris* is known from the islands Hokkaido, Honshu and Oshima. Savchenko (1973) described *autumnalis* from the island Moneron near southern Sakhalin and from Shikotan, adding (1970) Kunashir. Riedel (1917, 1918) and Alexander & Alexander (1973) reported *palloris* from Taiwan (Formosa) but these records apparently refer to *sinensis* Edwards. Out of the Riedel collection (IPSFK) Prof. Dr. G. Morge kindly sent me the only *palloris* det. Riedel specimen from Taiwan, which I recognized as *sinensis*.

The species is most abundant in May and ear-

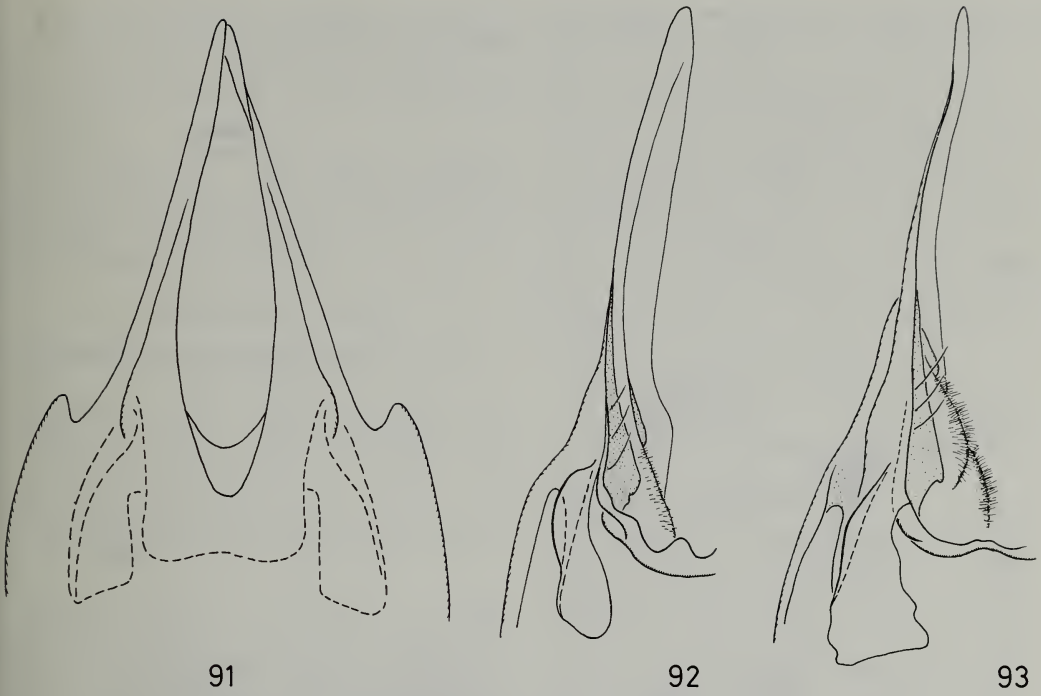


Fig. 91. *N. bifusca*. Female sternite 8 and hypovalvae, ventral view. Figs. 92—93. Right hypovalva, dorsal view. Fig. 92. *N. pallida*. Fig. 93. *N. palloris*.

ly June, but is also frequent in the second halt ot July until mid-September.

Discussion. — Females of *palloris* and *pallida* can be separated only by internal characters of the hypovalvae. The female holotype of *palloris* (Coquillett) was not investigated by the present author with respect to these characters. Nevertheless it is assumed that *palloris* (Coquillett) is conspecific with *palloris* as presented in this paper and not with *pallida*. The female holotype of *palloris* is labelled "Mitsukuri", presumably on Honshu, whereas *pallida* is distributed on Kyushu and adjacent smaller islands.

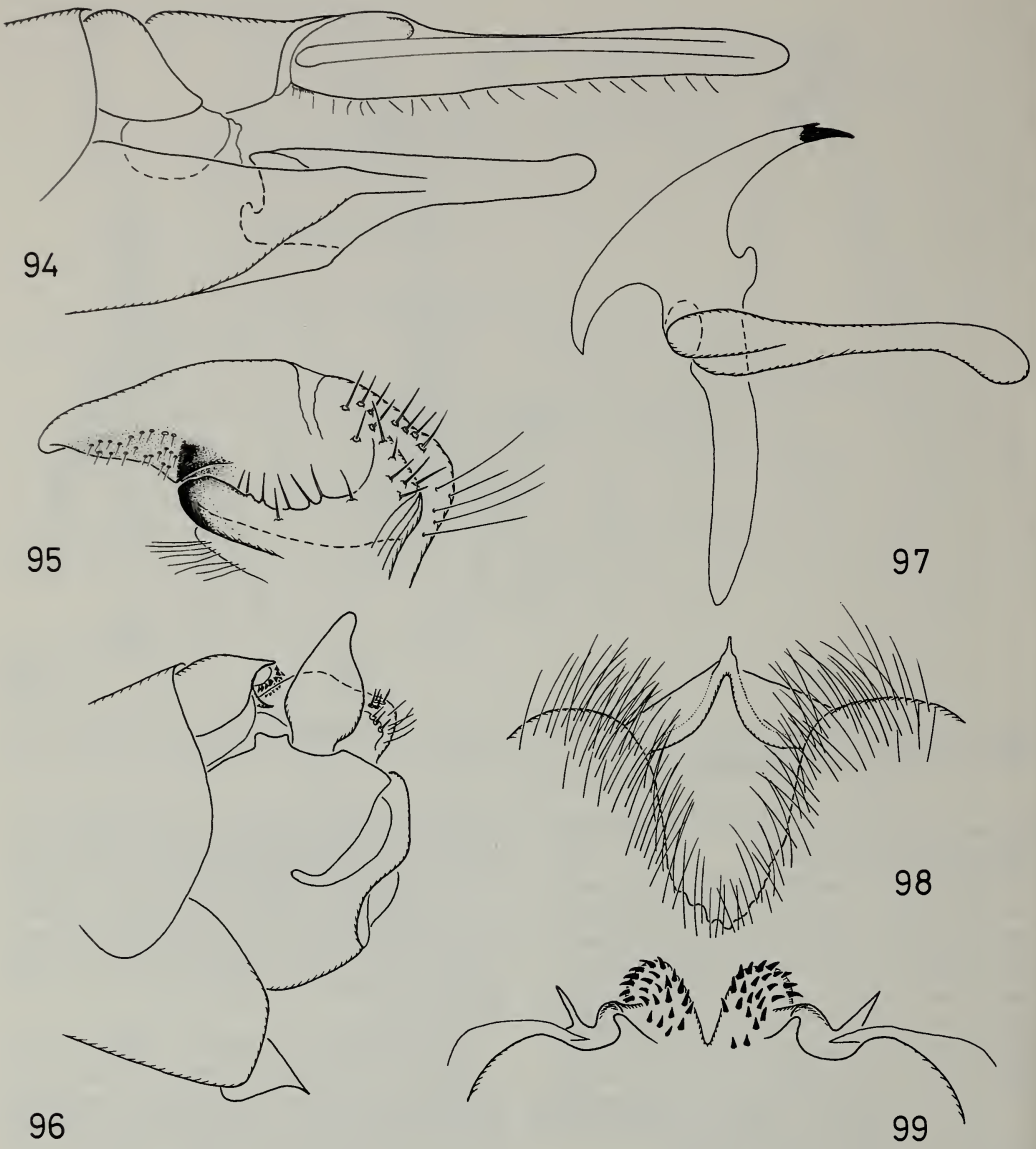
THE *CROCATA* GROUP

Nephrotoma neopratensis Alexander, 1921
(figs. 94—99)

Nephrotoma neopratensis Alexander, 1921: 132, 133. Alexander, 1925c: 4. Masaki, 1933a: 91. Ishida, 1955: 122.
Pales pullata; Savchenko, 1973: 121—123.

Material examined. — Holotype ♀, in good condition, a wing on slide 1834, specimen labelled "Sapporo, Japan May 26, 1916 S. Kuwayama" "Holotype *Nephrotoma neopratensis* C. P. Alexander" (USNMA); other material: 9♂ 9♀, Hokkaido; 5♂ 5♀, Honshu; 1♂, Shikotan (Misaki, Iyo); 1♂ 1♀, North Korea (Ompo, situated a few miles inland from the coast just South of 42°N); 1♀, South Korea (8 mi SW Kangnung).

Characteristics. — Belongs to the *crocata* subgroup (Oosterbroek, 1980) the species of which have the apex of the adminiculum spined (fig. 97) and possess a spine on the ventral surface of the intromittent organ, usually just in front of the adminiculum, as in *neopratensis*. *N. neopratensis* is a large species (body length ♂: up to 16 mm, ♀: up to 20 mm) and mostly resembles *pullata*. The species is characterized as follows. Occipital marking large and rounded with a narrow and short prolongation on tubercle; basally about as broad as prescutum, sometimes narrowly but usually not in contact with the eyes, which are surrounded by yellow. Coxae, abdominal segment 1 and almost entire thorax dusted grey, region below paratergites broadly yellow, as are the parascutella. Scutal



Figs. 94—99. *N. neopratensis*. Fig. 94. Ovipositor, lateral view. Fig. 95. Left inner dististyle, from outside. Fig. 96. Hypopygium, lateral view. Fig. 97. Adminiculum and left gonapophysis, lateral view. Fig. 98. Medial appendage of male sternite 8, ventral view. Fig. 99. Extension of male tergite 9, dorsal view.

stripes and scutellum blackened, lateral stripes of scutum 1 straight. Abdomen with continuous dorsal and lateral stripes; in the male dorsal stripe about as broad as scutellum, posterior segments and hypopygium blackened and sternites with elongate ventral markings; in the female dorsal stripe broader and individual spots triangular and along hind margin almost or actually in contact with lateral stripes, sternites with a continuous ventral stripe, segment 8 and tergites 9 and 10 blackened. Male hypopygium as in figs. 95—99, hind margin of sternite 8 with a peculiar shaped medial appendage; ovipositor as in fig. 94.

Distribution and period of flight. — Known from Hokkaido, Honshu, Shikoku (Iyo), South and North Korea. Adults are on the wing during about six weeks, from the end of April until mid-June.

Discussion. — The species is reported by Savchenko (1973) under *pullata*. His *neopratensis* shows a crest on the inner dististyle and a different colour-pattern and apparently is a not yet described species from Sakhalin.

THE *BREVIPENNIS* GROUP

Nephrotoma hirsuticauda Alexander, 1924
(figs. 100—104)

Nephrotoma hirsuticauda Alexander, 1924: 597—599. Alexander, 1925c: 2, 4. Masaki, 1933a: 91. Ishida, 1955: 121. Savchenko, 1970: 121. Savchenko, Violovich & Narchuk, 1972: 82.

Pales hirsuticauda; Zinovjev & Savchenko, 1962: 556, 562, 566, 567, 569. Savchenko & Krivolutzkaya, 1966: 46, 56. Savchenko, 1973: 110—112.

Material examined. — Holotype ♂, in good condition, labelled: "Sapporo, Japan July 1921 S. Kuwayama" "Holotype *Nephrotoma hirsuticauda* C. P. Alexander" (USNMA); paratypes: 2♂ 2♀, Sakhalin, Toyohara (= Yuzhno-Sakhalinsk), 20—23.vii.1923 (1♂ 2♀ USNMA, 1♂ BMNH); other material: 1♂ 1♀, Sakhalin (Konuma; Toyohara = Yuzhno-Sakhalinsk); 4♂ 4♀, Hokkaido; 1♂, Honshu (Tochigi, Nikko); 3♂, Primorskiy kray (Jakovskoye; Kamen Ribolov. Oz. Khanka); 1♀, China (Manchuria, Ha-erh-pin = Charbin).

Characteristics. — *N. hirsuticauda* belongs to the *brevipennis* group, comprising the three species from Madeira (*brevipennis* (Wollaston), *lucida* (Schiner), *antithrix* (Mannheims)), and a number of Nearctic species (*ferruginea* (Fabricius), *abbreviata* (Loew), *suturalis* (Loew), *navajo* Alexander). The group is characterized by the shape of the gonapophyses, of the inner dististyle and of the extension of the male tergite 9. The presence of an oval, serrate membrane at the intromittent organ is known in this group only and is found in the species of Madeira, in *navajo* and in *hirsuticauda*. In general *hirsuticauda* mostly resembles *suturalis*. Males of *hirsuticauda* are easily recognized by the shape of the extension of tergite 9 (fig. 102) and by the tufts of long hairs at sternite 8 (fig. 100).

Females share the following characters. Occipital marking small, triangular, ranging from yellow to dark brown, sometimes with a narrow prolongation on tubercle. Pronotum entirely yellowish brown. Scutal stripes usually not uniformly coloured but in part dark brown and light or yellowish brown; at least stripes on scutum 2 lighter in the middle; lateral stripes of scutum 1 anteriorly outcurved, outcurved part shining. Scutellum yellow. Mediotergite yellow, posterior part and usually antero-medial part transparent and light brown. Femora and tibiae light brown, tips dark brown. Abdominal tergites 2—7 (8) posteriorly with rounded to oval dorsal spots situated well in front of the hind margins, spots about as large as scutellum; tergites laterally with a continuous dark brown stripe. Cerci and hypovalvae as in fig. 101.

Specimens from the continent are usually much darker coloured (f. *tristis* of Savchenko, 1973), but show no differences in genital characters.

Distribution and period of flight. — *N. hirsuticauda* is known from Krasnoyarskiy kray (Kansk), Irkutskaya oblast, Buryatskaya ASSR, northern Mongolia, Amurskaya oblast, Khabarovskiy kray (Khabarovsk), Primorskiy kray, NE China (Ha-erh-pin), North Korea (Hamgyong nando), Sakhalin, Kunashir, Hokkaido, Honshu (Nikko). The period of flight in Japan and Sakhalin is from mid-June until mid-September, on the continent from mid-May to the end of August.

THE *STYLACANTHA* GROUP

Nephrotoma medioflava spec. nov.
(figs. 105—110)

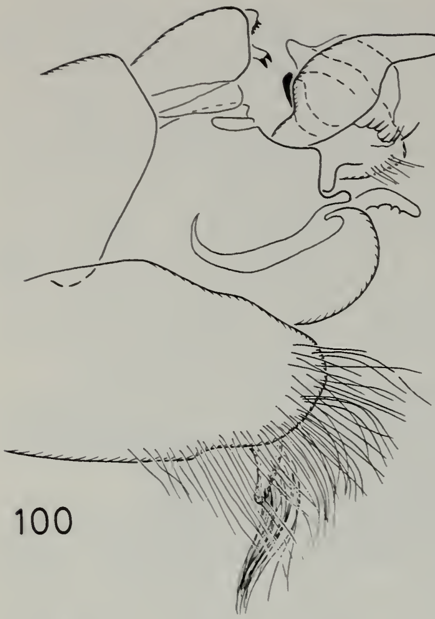
Type-material. — Holotype ♂, in good condition, labelled "Japan Okinawa Shuri 300' 28.ii.1923" "Holotype *Nephrotoma medioflava* P. Oosterbroek" (USNMA); paratypes: 22♂ 6♀, labelled as the holotype except for dates, running from "12.i.1923" to "27.iii.1923" and for "paratype" (17♂ 4♀ USNMA, 5♂ 2♀ ZMA); other material: 1♀, Okinawa, Katsudake, 10.vii.1951 (ZMA); 1♀, Okinawa, Koza, vi.1958 (ZMA).

Characteristics. — As indicated in the key, the transverse yellow spot on the mid-dorsal part of the dorsally brown to dark brown tergite 1 separates this species from all other Japanese species.

Description.

Body length ♂: 11—12 mm, ♀: 14—16 mm; wing length ♂: 11—13 mm, ♀: 12—14 mm.

Head. — Yellowish, dorsal rostrum and vertex more brownish. Occipital marking shining brown, triangular with the base about as broad



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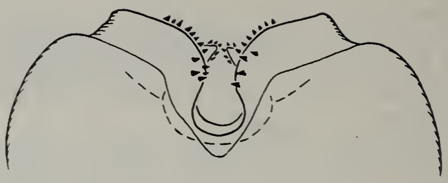

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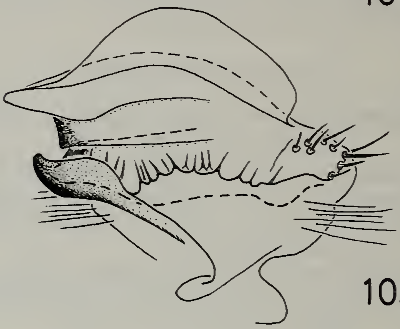

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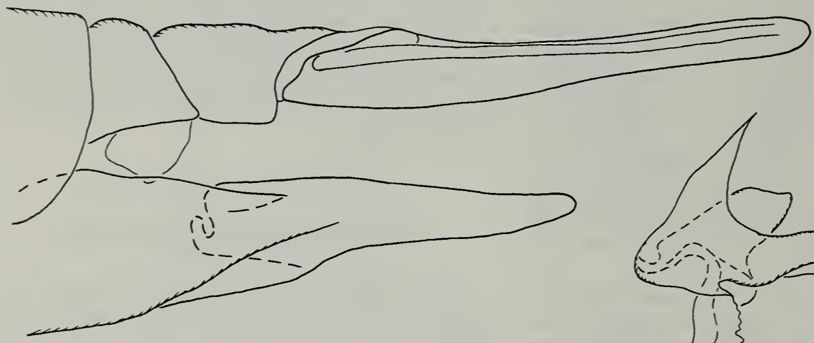

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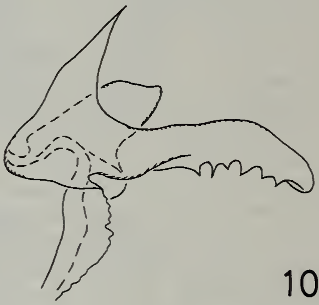

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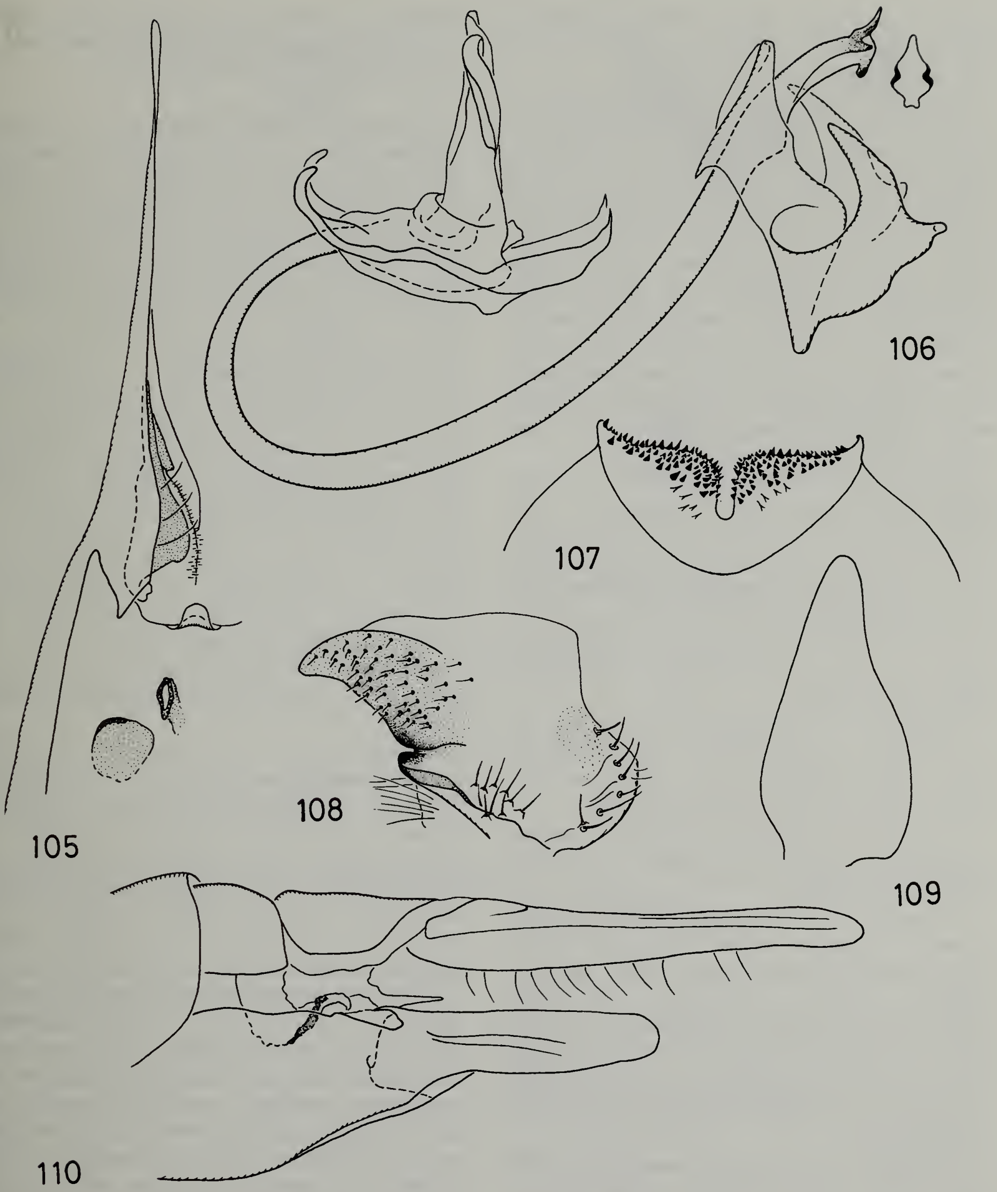
Figs. 100—104. *N. hirsuticauda*. Fig. 100. Hypopygium, lateral view. Fig. 101. Ovipositor, lateral view. Fig. 102. Extension of male tergite 9, dorsal view. Fig. 103. Left inner dististyle, from outside. Fig. 104. Adminiculum and left gonapophyses, lateral view.

as neck and anteriorly reaching halfway tubercle, usually with a narrow, dull brown prolongation to top of tubercle. Between tubercle and eye margin vague brown spots. Antennae 13 segmented; scape and pedicel yellow to light brown; flagellar segments dark brown in the male and distinctly reniform beyond flagel 1; female flagellar segment 1 light brown, following segments light brown to brown with the bases dark brown.

Thorax. — Pronotum dorsally brownish yellow, lateral brown or in part dark brown coloration continued on coxae 1. Lateral thorax and coxae 2 and 3 yellowish, dorsal part of anatergite dark brown. Dorsal thorax yellow between stripes, sometimes more brownish. Scutal stripes usually not uniformly coloured, ranging from brown to dark brown; medial stripe on scutum 1 usually with a longitudinal, lighter coloured mark on anterior part; lateral stripes on scutum 1 outcurved, the outcurved part shining and usually lighter coloured than stripes



Figs. 105—110. *N. medioflava*. Fig. 105. Right hypovalva, dorsal view. Fig. 106. Semen pump, intromittent organ and adminiculum with gonapophyses, lateral view; top right: rear view of intromittent organ. Fig. 107. Extension of male tergite 9, dorsal view. Fig. 108. Left inner dististyle, from outside. Fig. 109. Left outer dististyle, from outside. Fig. 110. Ovipositor, lateral view.

themselves. Antero-lateral corners of scutum 2 with a dark brown dull seam. Scutellum transparent, yellow to light brown. Mediotergite yellow on antero-medial part, lateral parts brown to dark brown, posterior part ranging from yellow to brown. Trochanters brownish yellow; femora basally brownish yellow, growing brown towards apex; tibiae brown; apices of femora and tibiae broadly dark brown; tarsi dark brown; male claws toothed. Wings with a light brown tinge; stigma distinct, brown to dark brown, with a few or up to 25 macrotrichia; wingtip with a brownish cloud.

Abdomen. — Tergite 1 broadly brown to dark brown with a transverse yellowish spot on the middorsal part, lateral parts pale yellow, hind margin yellow. Tergites 2—6 or 2—7 with a broad brown to dark brown stripe, interrupted on anterior part of tergites, stripe in the male about as broad as scutellum, in the female broader than mediotergite with the individual spots slightly triangular towards hind margin. Tergites 2—6, 2—7 or 2—8 with a dark brown, almost uninterrupted lateral stripe. Male tergite 8 and usually also tergite 7 and sternite 8 largely dark brown; female tergite 8 sometimes largely dark brown.

Hypopygium. — Brownish. Extension of tergite 9 with a small medial incision (fig. 107). Outer dististyle of moderate length (fig. 109). Inner dististyle with a broad anterior beak (fig. 108). Intromittent organ short and robust with the apex differentiated (fig. 106). Gonapophyses upcurved with short posteriorly directed processes (fig. 106). Hind margin of sternite 8 straight, unmodified.

Ovipositor. — Lateral aspect as in fig. 110, dorsal aspect of hypovalvae as in fig. 105, with short rostral extensions and two sclerotized parts on each side in front of hypovalvae.

Distribution and period of flight. — Known from Okinawa only and apparently on the wing from January to July.

Discussion. — *N. medioflava* is related to *stylacantha* Alexander, known from the Chinese provinces Fukien and Kiangsu. They share the following characters. Transverse and yellow dorsal spot on tergite 1, extension of male tergite 9 very similar, intromittent organ short and thick and apically modified. The inner dististyle of *stylacantha* as well as the gonapophyses are very different.

Etymology. — The name *medioflava* refers to the yellow mark on the first abdominal tergite.

THE *REPANDA* GROUP

Nephrotoma repanda (Alexander, 1914) (figs. 111—114)

Pachyrhina repanda Alexander, 1914: 162, 163.

Nephrotoma repanda; Masaki, 1933a: 90. Alexander, 1954: 277, 278. Ishida, 1955: 123. Savchenko, 1970: 121.

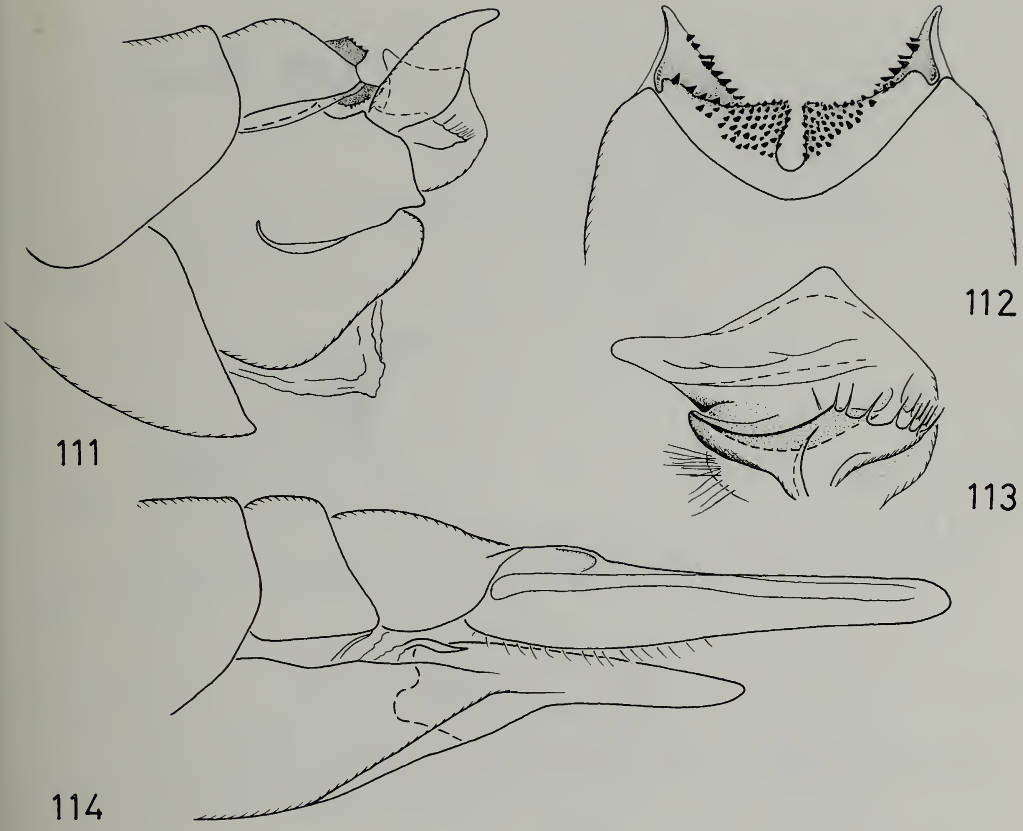
Pales repanda; Savchenko & Krivolutzkaya, 1966: 46, 56. Savchenko, 1973: 62—64.

Nephrotoma grahamiana Alexander, 1940b: 403—405 (hypopygium = fig. 46, not 45). (**Syn. nov.**)

Pales grahamiana; Savchenko, 1973: 62.

Material examined. — Holotype ♂ of *repanda*, three slides with one wing, left inner and outer dististyle and abdominal end, labelled "Holotype 830 *Nephrotoma repanda* (Alex.) ♂ Tokyo, Japan Aug. 1912 (Ex Kuwana) 830" (USNM, the type-specimen was not found). Holotype ♂ of *grahamiana*, in good condition, labelled "W. China Omei Shuang Fei Chiao 3000′ vi—14.35 Graham" "Holotype ♂ *Nephrotoma grahamiana* C. P. Alexander" (USNM); paratypes: 4♂ para(topo)types with dates from 14—22.vi.1935 (2♂ complete USNM, 1♂ USNM with slide USNMA, 1♂ slide only USNMA); other material: 4♀, Hokkaido (Ishikari; Tokachi); 4♂ 3♀, Honshu; 2♂ 1♀, Kyushu (Oita; Kujusan; Kumamoto); 6♂ 2♀, Shikoku: 2♀, Sado; 1♂, Tsushima (Mt Ariake); 1♂, Primorskiy kray (Wladiwostok); 1♂, North Korea (Ompo, situated a few miles inland from the coast just South of 42°N); 4♀, South Korea (16 & 18 mi NE and 6 mi E of Seoul); 5♂, China (Szechwan: Pehlüting and Mt Omei).

Characteristics. — *N. repanda* is closely related to *dutti* Alexander, 1963 (= *condylophora* Alexander, 1970) from the southern Himalayas (Murree; Darjeeling; Bomdila). The species is characterized by the yellow thorax with only the scutal stripes dark brown; the medial stripe on scutum 1 and the stripes on scutum 2 have the posterior ends dull. Head largely yellow, dark brown coloration of dorsal rostrum, of spots on either side of tubercle and of small triangular occipital marking variable in expression. Male tergites 2—6 sometimes with a vague dorsal stripe about as broad as scutellum and sometimes infuscated along lateral margin; tergite 7 or segment 7, segment 8 and hypopygium largely dark brown. Hypopygium, extension of tergite 9 and inner dististyle as in figs. 111—113, the hind margin of sternite 8 with a small medial incision covered by a membrane, sides of incision and membrane covered with longer white hairs. Apex of intromittent organ bifid. Female abdomen with a dark brown dorsal stripe on tergites 2—7, about as broad as scutellum or mediotergite and interrupted in front of hind margin of tergites, lateral margin of tergites usually infuscated or with a dark brown lateral stripe along the margins. Tergite 8 and basal part of sternite 8 darkened, apical part of



Figs. 111—114. *N. repanda*. Fig. 111. Hypopygium, lateral view. Fig. 112. Extension of male tergite 9, dorsal view. Fig. 113. Left inner dististyle, from outside. Fig. 118. Ovipositor, lateral view.

sternite 8 with large and oval dark brown spots. Cerci relatively short and broad, hypovalvae slender (fig. 114).

Distribution and period of flight. — Known from Kunashir, Hokkaido, Honshu, Sado, Kyushu, Shikotan, Tsushima, southern Primorye, North and South Korea and China (Szechwan). Altitudes in Japan are up to 1200 m, in China up to 2000 m. The period of flight is from the end of May until early August.

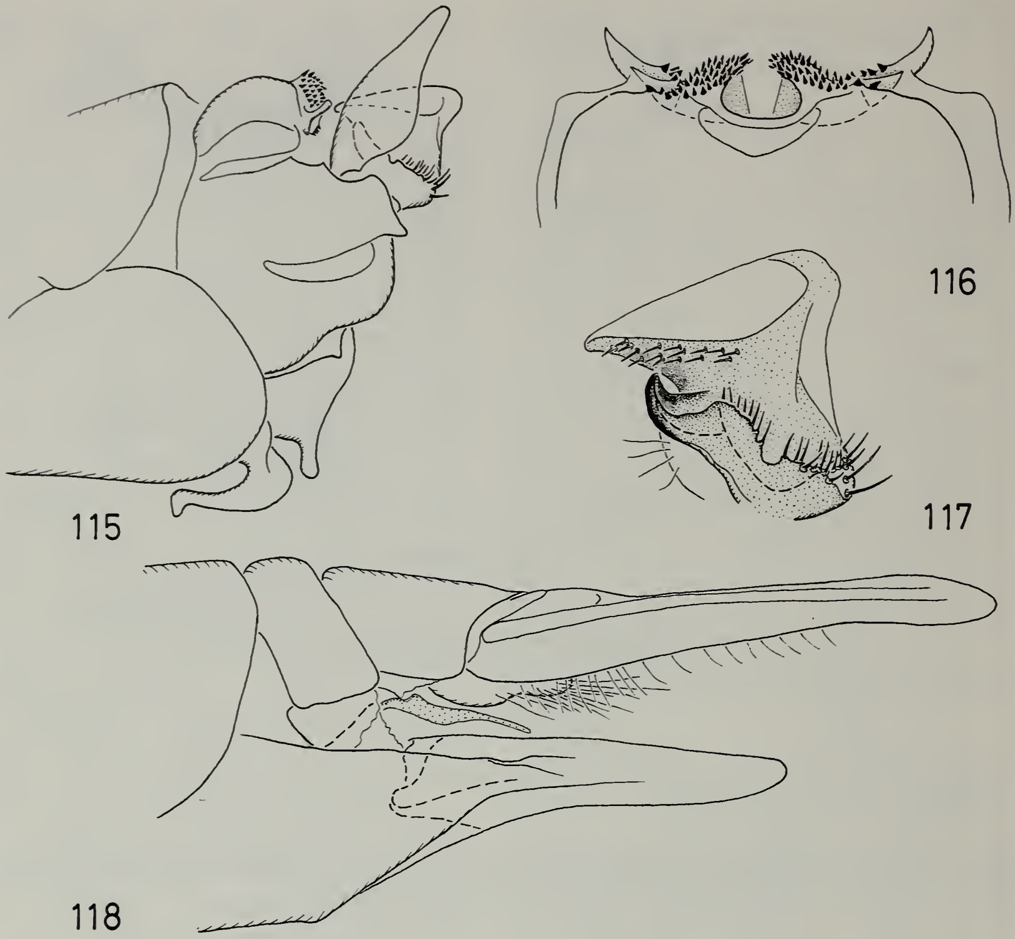
The *virgata* group

Nephrotoma virgata (Coquillett, 1898)
(figs. 115—118)

Pachyrhina virgata Coquillett, 1898: 306. Alexander, 1914: 163, 164.
Nephrotoma virgata; Alexander, 1920: 22, 23. Alexander, 1925c: 20. Esaki, 1932: 148. Masaki, 1933a: 90. Alexander, 1953c: 149, 150. Ishida, 1955: 124 (in part). Alexander & Alexander, 1973: 38 (in part).
Pales virgata; Savchenko, 1973: 51—53.
Nephrotoma decrepita Alexander, 1935a: 140—142. (**Syn. nov.**)
Pales decrepita; Savchenko, 1973: 53.
Limnophila japonica Esaki, 1957: 1532 (synonymy after Alexander, 1953c).
Pachyrhina serricornis; Brunetti, 1912: 343 (Japanese records only).

The records from Taiwan (Formosa) by Edwards (1916), Riedel (1917), Brunetti (1918, 1920), Ishida (1955) and Alexander & Alexander (1973) probably refer to different species, see under distribution.

Material examined. — Holotype ♂ of *virgata*, in good condition, labelled: "Japan Mitsukuri" "Type no. 3967 U.S.N.M." "*Pachyrhina virgata* Coq." (USNM; Mitsukuri presumably lies on Honshu). Holotype ♂ of *decrepita*, in fair



Figs. 115—118. *N. virgata*. Fig. 115. Hypopygium, lateral view. Fig. 116. Extension of male tergite 9, dorsal view. Fig. 117. Left inner dististyle, from outside. Fig. 118. Ovipositor, lateral view.

condition, abdominal end and one wing on slide 5736, specimen labelled: "Mt Omei Szechwan China 4500 ft aug. 15, '29" "Holotype *Nephrotoma decrepita* C. P. Alexander" (USNMA); other material: 20♂ 21♀, Hokkaido; 49♂ 49♀, Honshu; 7♂ 7♀, Shikoku; 15♂ 9♀, Kyushu; 1♀, Sado; 1♂, Tsushima; 1♀, Oshima; 1♂ 1♀, Amami; 1♂, North Korea (Puksu Pyaksan in Kankyo Nando, the second highest peak in Korea, appr. 40°40′ N 127°45′ E; 2♂ 7♀, South Korea (Ch'unch'ŏn; 16, 18 & 20 mi NE and 6 mi E of Seoul); 3♂ 9♀, China (Lichuan, Hupeh; Chungching, Mt Omei, Szechwan).

Characteristics. — *N. virgata* males can be easily recognized by the shape of the extension of tergite 9 (fig. 116), of the inner dististyle (fig. 117), and by the backfolded appendage at sternite 8 (fig. 115). Females have the cerci broad and with the blunt ending apical part slightly downcurved (fig. 118). Both sexes have a small occipital marking and the lateral stripes on scutum 1 are usually somewhat outcurved anteriorly, the outcurved part ranges from dull to almost as shining as stripes themselves. The abdominal tergites bear brown to dark brown dorsal markings, the expression of the markings is very variable, ranging from almost absent to occupying the largest part of the tergite but in all instances the hind margins of the tergites are broadly yellow, especially on tergites 2—6; lateral and ventral markings are absent and the abdominal end is not darkened. The species is

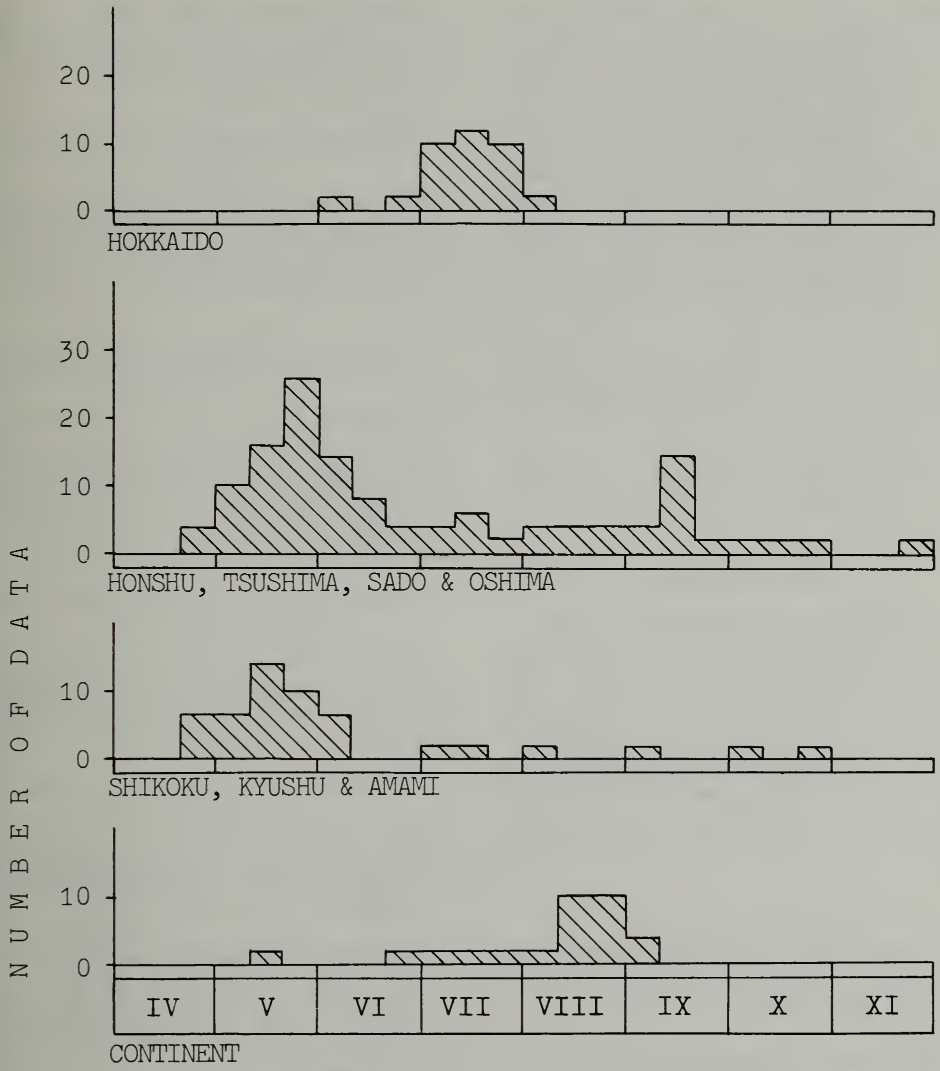


Diagram 1. Period of flight of *N. virgata*. Months divided into periods of 10 days. Number of data relates to number of samples, not to number of specimens.

not closely related to any of the other Japanese species but more to species found in central and southeast Asia (f.e. *consimilis* Brunetti, 1911; *scurroides* de Meijere, 1904).

Distribution and period of flight. — The species is known from the Japanese islands Hokkaido, Honshu, Tsushima, Sado, Oshima, Shikoku, Kyushu and Amami. It is recorded from the eastern USSR by Alexander (1925c) and Savchenko (1973; Khasan, Wladiwostok, Primorskiy kray); Alexander (1925c) also mentions Kudia river, Amagu, which could not be traced, and Okeanskaya, a doubtful record as it is South of Kamchatka, far outside the presently known range of *virgata*. During this study material was examined from North Korea and South Korea, other Korean localities are mentioned by Masaki (1933a), but these are doubtful, the figures of *virgata* from Korea in Masaki (1933b) refer to a species of the *dorsalis* group. Material was also examined from China (W Hupeh; Szechwan). Out of the Riedel collection

(IPSFK) Prof. Dr. G. Morge kindly sent one specimen det. *virgata* by Riedel from Taiwan. The specimen was identified by me as *definata* Alexander, 1935. In spite of all the records from Taiwan it is most probable that *virgata* does not occur on the island. Other records of *virgata* in SE Asia are based on the synonymy by Edwards (1927) of *scurroides* de Meijere, 1904, with *virgata*, but *scurroides* is a valid species (types in ZMA). Recorded altitudes are up to 2000 m. The period of flight throughout the distribution range is given in diagram 1; on Hokkaido the flight-period is short, June and most frequently July; on the other islands the species is most frequent in spring but adults can be found during quite long a period, from the end of April until the end of October or November; on the continent adults are on the wing from mid-May until early September and are most frequent in August.

THE *SINENSIS* GROUP

Nephrotoma sinensis (Edwards, 1916)

This species is recorded from Japan by Esaki (1932), Masaki (1933a), Alexander (1953a, 1953c) and Savchenko (1973). During this study no *sinensis* material from Japan was encountered. It is almost certain that the above-mentioned records refer to species of the *palloris* group. As in *sinensis*, some members of this group have the costal margin of the wing darkened.

THE *DORSALIS* GROUP

The following species belong to the *dorsalis* group, and are discussed and figured in very detail by Tangelder (1984).

Nephrotoma electripennis Alexander, 1953
(figs. 123, 124)

Endemic to Japan (Shikoku, Kyushu); period of flight: mid-May until mid-June (Tangelder, 1984: 32, 33, figs. 44—56, map 2).

Nephrotoma nigricauda Alexander, 1925
(figs. 121, 122)

Endemic to Japan (Hokkaido, Honshu) and the Kurile (Kunashir); period of flight: mid-May until the end of July (Tangelder, 1984: 33—36, figs. 57—68, map 2).

Nephrotoma minuticornis Alexander, 1921
(fig. 119)

Sugarbeet crane-fly (see p. 236)

Distributed from southern Sakhalin to Kyushu and Shikoku; period of flight: the end of May until early October (Tangelder, 1984: 66—70, figs. 201—210, map 8).

Nephrotoma sachalina Alexander, 1924
(fig. 120)

Distribution: southern Kamchatka, southern Sakhalin, the Kurile and Hokkaido; period of flight: mid-June until the end of August (Tangelder, 1984: 45—48, figs. 88, 101, 103—112, map 4).

Nephrotoma difficilis Tangelder, 1984
(figs. 126, 128, 130, 131)

Distributed from central Asia (Krasnoyarsk and Tuva regions) to southern Primorye, North Korea, southern Sakhalin and Hokkaido; period of flight: mid-June until mid-August (Tangelder, 1984: 53—57, figs. 124, 134, 137—148, map 5).

Nephrotoma angustistria Alexander, 1925
(figs. 127, 129, 132)

Endemic to Japan (Hokkaido, Honshu); period of flight: mid-May until early September (Tangelder, 1984: 59—61, figs. 126, 136, 161—169, map 5).

Nephrotoma cirrata Tangelder, 1984
(fig. 133)

Endemic to Japan (Hokkaido); recorded from June 25/26 and July 6 and 12 (Tangelder, 1984: 61—63, figs. 170, 172—181, map 6).

Nephrotoma gaganboi Tangelder, 1984
(fig. 134)

Endemic to Japan (Honshu); recorded from June 30 only (Tangelder, 1984: 63, 64, figs. 182—189, map 6).

Nephrotoma microcera Alexander, 1921
(fig. 125)

Known from Japan (Hokkaido, Honshu) and South Korea (18 mi NE Seoul); period of flight: mid-May until the end of September (Tangelder, 1984: 64—66, figs. 171, 190—200, map 7).

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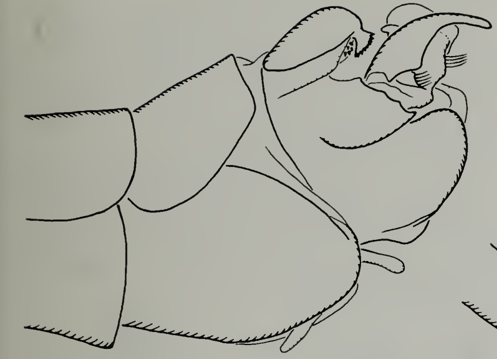

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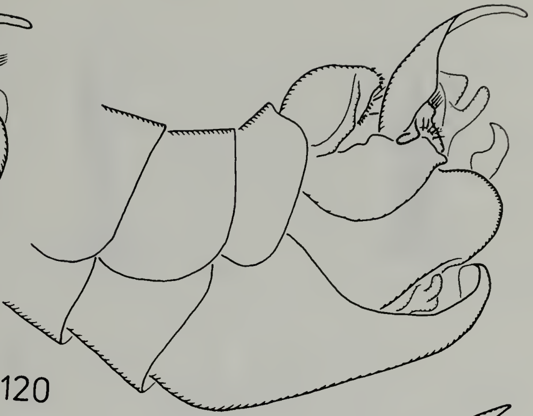

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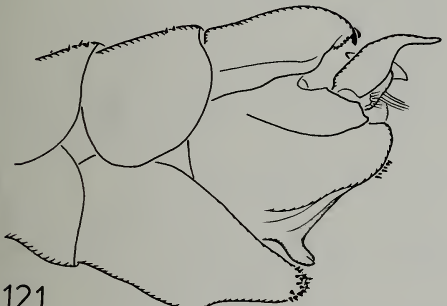

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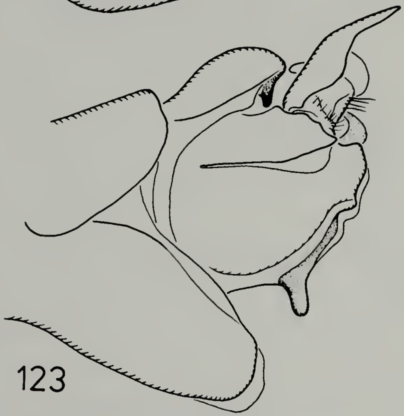

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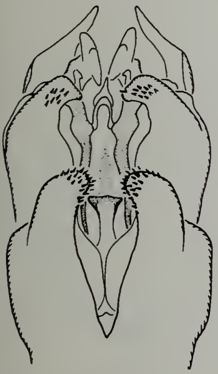

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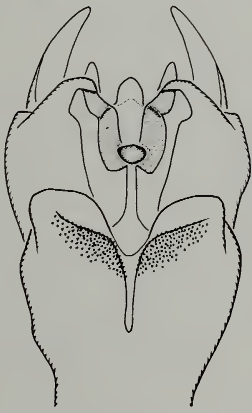

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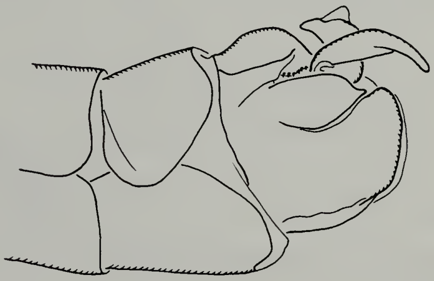

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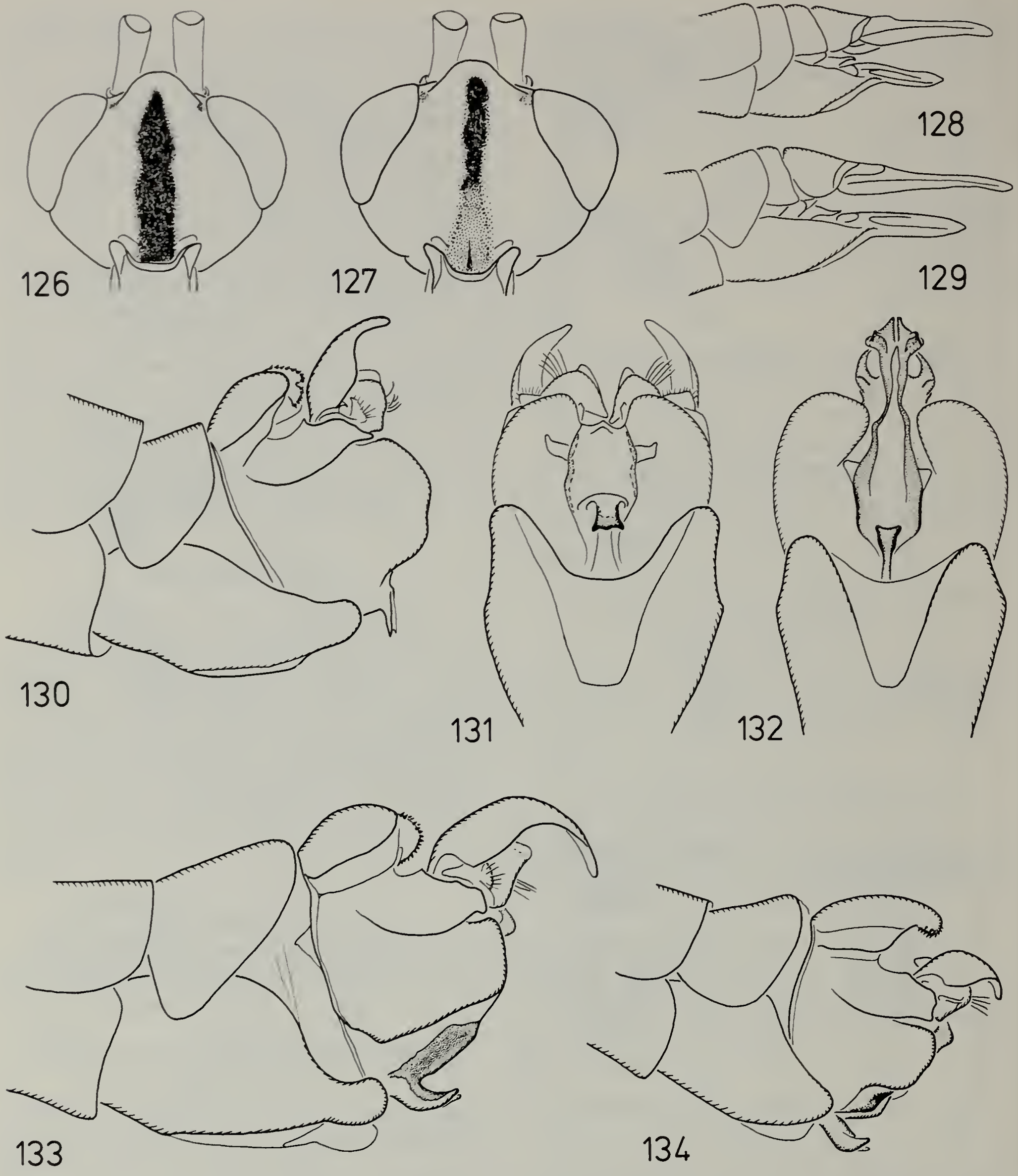
Figs. 119—121, 123, 125. Hypopygium, lateral view. Fig. 119. *N. minuticornis*. Fig. 120. *N. sachalina*. Fig. 121. *N. nigricauda*. Fig. 123. *N. electripennis*. Fig. 125. *N. microcera*. Figs. 122, 124. Hypopygium, ventral view. Fig. 122. *N. nigricauda*. Fig. 124. *N. electripennis*. (With kind permission redrawn from Tangelder, 1984, Beaufortia, 34)

eral Education, Kyushu University). These shipments included material of the new (sub)species *vana vana*, *vana nigrovana* and *pallida*, contained a number of rare species, several of which were known from the types only, and added much to our knowledge of the distribution of the species.

The most important C. P. Alexander collec-



Figs. 126, 127. Head, dorsal view. Fig. 126. *N. difficilis*. Fig. 127. *N. angustistria*. Figs. 128, 129. Ovipositor, lateral view. Fig. 128. *N. difficilis*. Fig. 129. *N. angustistria*. Figs. 130—134. Hypopygium. Fig. 130. *N. difficilis*, lateral view. Fig. 131. *N. difficilis*, ventral view. Fig. 132. *N. angustistria*, ventral view. Fig. 133. *N. cirrata*, lateral view. Fig. 134. *N. gaganboi*, lateral view. (With kind permission redrawn from Tangelder, 1984, Beaufortia 34)

tion could be studied through the generous cooperation of W. N. Mathis (National Museum of Natural History, Smithsonian Institution, Washington, D.C.).

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